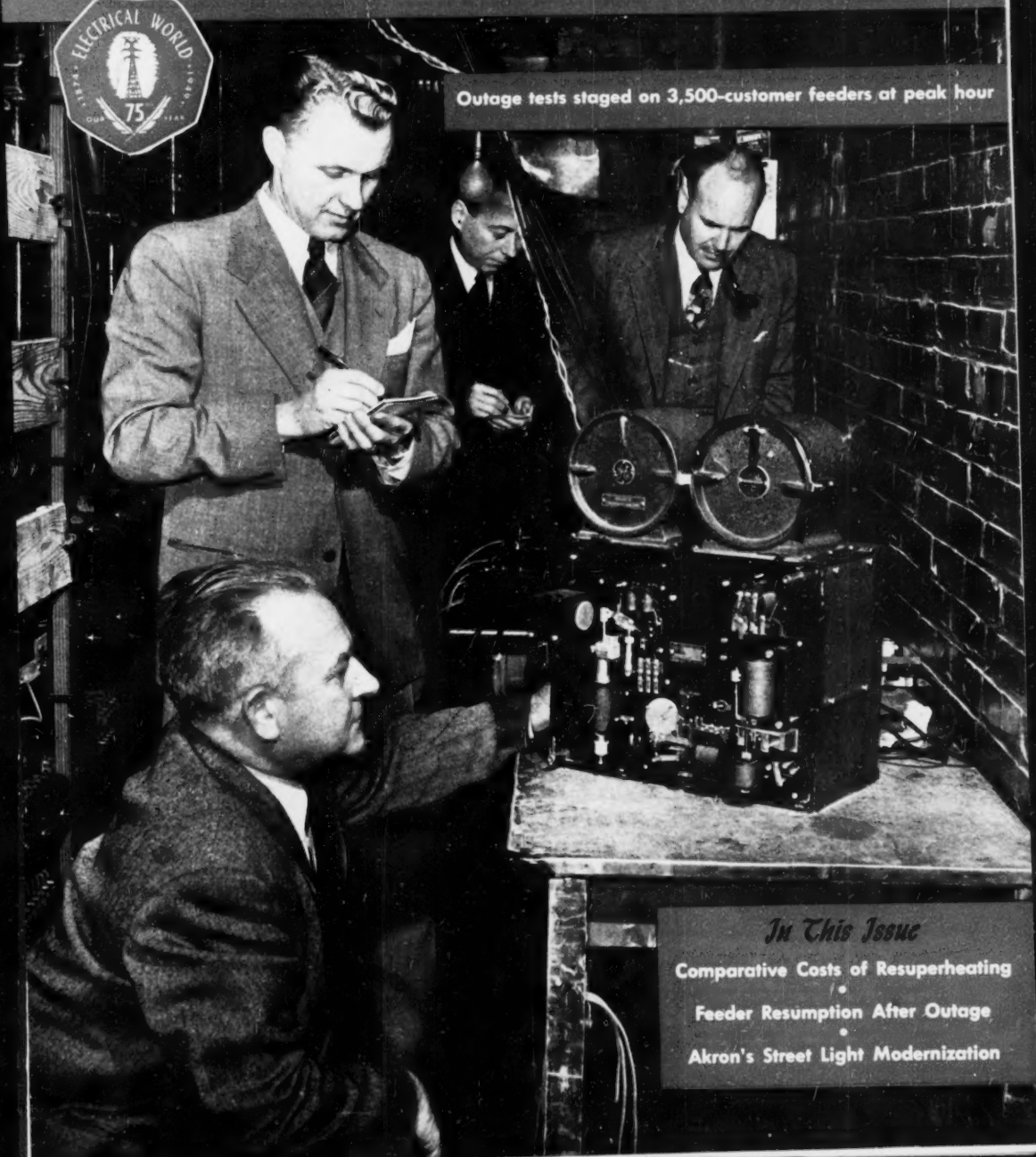
ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

SEPTEMBER 10, 1949



Outage tests staged on 3,500-customer feeders at peak hour

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Comparative Costs of Resuperheating

•

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•

Akron's Street Light Modernization

(Model 901) PORTABLE TEST INSTRUMENTS available in DC, Model 901—and AC, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.

SENSITIVE RELAYS a line of sensitive relays including the Model 705 which provides positive control at levels as low as ½ microampere. Non-chattering magnetic contacts handle up to 10 watts at 120 volts.

(Model 622) ULTRA-SENSITIVE INSTRUMENTS portable DC and AC Thermo instruments for precision measurement of potentials and minute currents involving electronics, thermo-couples or laboratory research.

INSTRUMENTS

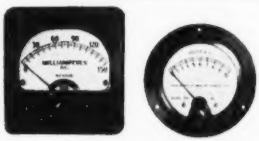
TO SPEED AND SIMPLIFY ELECTRONIC PRODUCTION AND MAINTENANCE

Illustrated are but a few of the many specialized instruments available from WESTON . . . all designed to simplify and speed-up electrical and electronic installations, production testing, and maintenance. For details, see your local representative, or write Weston Electrical Instrument Corporation, 618 Frelinghuysen Avenue, Newark 5, New Jersey.

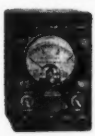
WESTON *Instruments*

ALBANY • ATLANTA • BOSTON • BUFFALO • CHARLOTTE • CHICAGO
CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • HOUSTON
JACKSONVILLE • KNOXVILLE • LITTLE ROCK • LOS ANGELES
MERIDEN • MINNEAPOLIS • NEWARK • NEW ORLEANS • NEW YORK
ORLANDO • PHILADELPHIA • PHOENIX • PITTSBURGH • ROCHESTER
SAN FRANCISCO • SEATTLE • ST. LOUIS • SYRACUSE • TULSA
IN CANADA, NORTHERN ELECTRIC CO., LTD., POWERLITE DEVICES, LTD.

(Model 798) MULTI-PURPOSE TUBE-CHECKER offering provision for testing Receiving Tubes — Voltage Regulator Tubes—Light Duty Thyratron Tubes such as 2A4—6D4—884—885—2051. Scale is calibrated "Good-Bad" as well as in mutual conductance range.



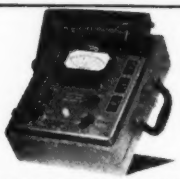
PANEL and SWITCHBOARD INSTRUMENTS a complete line of instruments in all types, sizes and ranges required for switchboard and panel needs . . . including DC, AC power frequencies and radio frequency, rectifier types and D.B. meters.



(Model 697) VOLT-OHM MILLIAMMETER one of a line of pocket-size meters, Model 697 combines a selection of AC and DC voltage, DC current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.

(Model 785) INDUSTRIAL CIRCUIT TESTER a versatile, portable tester for laboratory or maintenance needs, where an ultra-sensitive instrument is required. Provides 27 AC and DC voltage, AC and DC current, and resistance ranges. (DC sensitivity 20,000 ohms per volt.)

(Model 779, Type 1) SUPER-SENSITIVE ANALYZER small, light, compact, 26 range Volt-Ohm-Milliammeter with 5 DC voltage ranges, sensitivity of 1000 or 20,000 ohms per volt. AC temperature compensated. Self-contained power supply. Ideal for many production and test requirements.



(Model 769) ELECTRONIC ANALYZER incorporating a conventional Volt-Ohm-Milliammeter with self-contained power source—a high-impedance electronic Volt-Ohmmeter using 115 volt, 60 cycle power—a stable, probe-type, Vacuum Tube Voltmeter, for use to 300 megacycles.

ELECTRICAL WORLD

Published for 75 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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COVER—Checking the oscillogram prior to a relay test made with the cooperation of 3,500 residential customers. Left to right: Leland J. Audlin, relay engineer, Central New York Power Corp; H. C. Anderson and A. J. McConnell, central station engineering division, General Electric Co and M. H. Pratt, chief engineer, Central New York Power Corp

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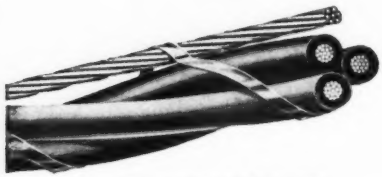
ELECTRICAL WORLD, Published weekly by McGraw-Hill Publishing Company, Inc. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd St., New York 18, N. Y. James H McGraw (1860-1948), Founder; James H McGraw, Jr, President; Curtis W McGraw, Vice President and Treasurer; Eugene Duffield, Senior Vice-President, Publications Division; Nelson Bond, Vice-President and Director of Advertising; J E Blackburn, Jr, Vice President and Director of Circulation; Joseph A Gerardi, Secretary. Subscription rates: Single copy 35 cents. In the United States, $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money at par.) Pan-American countries, $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Copyright 1949, by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents. Cable address McGRAW-HILL, New York. Member ABP Member ABC

HAZARD SELF-SUPPORTING AERIAL CABLE

***install this pre-assembled cable, messenger and binder* ALL IN ONE OPERATION**

• Multi-conductor Self-Supporting Aerial Cable for signal and control circuits. Varied insulation colors provide quick circuit identification.



• Three-conductor Self-Supporting Aerial Cable. Hazaprene protective jacket on each conductor makes splicing and terminating simple and fast.

ALUMINUM CONDUCTORS

• Hazard Self-Supporting Aerial Cable available with Aluminum Conductors. Ask your Hazard representative or write us for the facts about lightweight conductors for overhead service.

Where overhead service with insulated cable is indicated, Hazard offers you this simple, self-supporting cable construction that makes installation quick, easy and economical . . . that provides ample protection against tree branches and rough weather . . . that assures lasting, trouble-free, low-cost circuits.

With Hazard Self-Supporting Aerial Cable, specially compounded Submarine rubber insulation provides long-lived, moisture-resisting, electrical protection for the Hazaloy coated copper conductors. Over this insulation goes a tough Hazaprene jacket that's well known for its unusual resistance to sun, cold, moisture, abrasion.

Bound to the cable by a spirally wound metallic tape, a strong Copperweld messenger gives full support between points of suspension. This simple, but effective *all-in-one construction* (cable, messenger, binder) of Hazard Self-Supporting Aerial Cable provides the ideal answer to the problems of installing and maintaining overhead circuits. For more information, ask your Hazard representative or write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

6403

HAZARD

insulated wires and cables for every electrical use

The Records Prove the Performance of Electroline Dead Ends

Hundreds of thousands of Electroline Dead Ends have proven themselves under the most demanding conditions . . . where the highest standards of performance are required. Original installations are still in uninterrupted service.

Originators of these dependable Dead Ends and other time saving power line products, **Electroline** is always ahead of the field —first with worthwhile improvements. Bulletins sent on request.

Electroline Company

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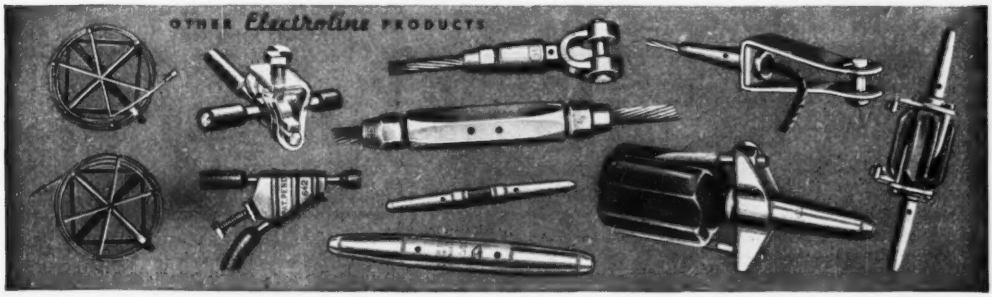
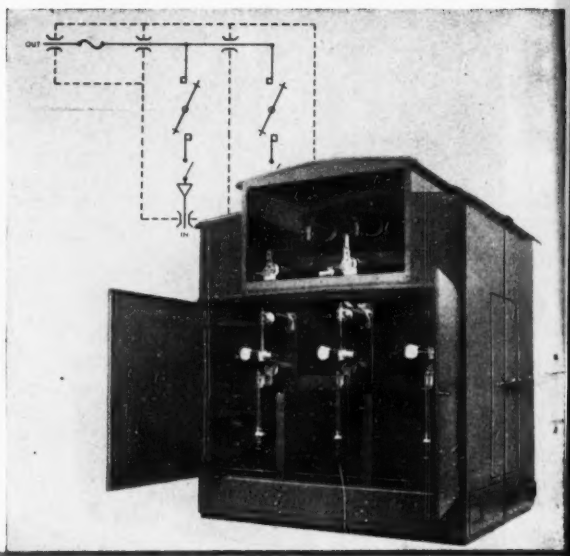


WHERE
HIGH VOLTAGE SWITCHGEAR
MUST BE:

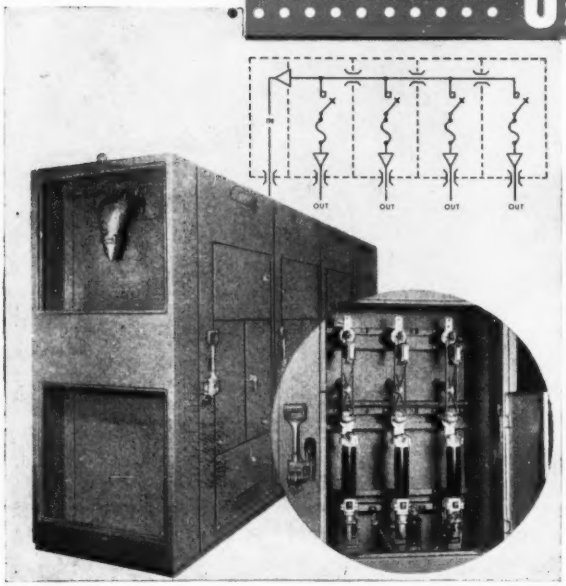
RELIABLE
ENCLOSED
PACKAGED

AND YET

LOW IN COST



USE S & C METAL-



Utilizing Alduti Interrupters and SM Power Fuses, S & C Metal-Enclosed Switchgear Units offer these important advantages:

● ***Large Savings in Equipment Costs*** as compared with circuit breakers, for Primary Switchgear, Secondary Switchgear, and Load Center Switchgear installations.

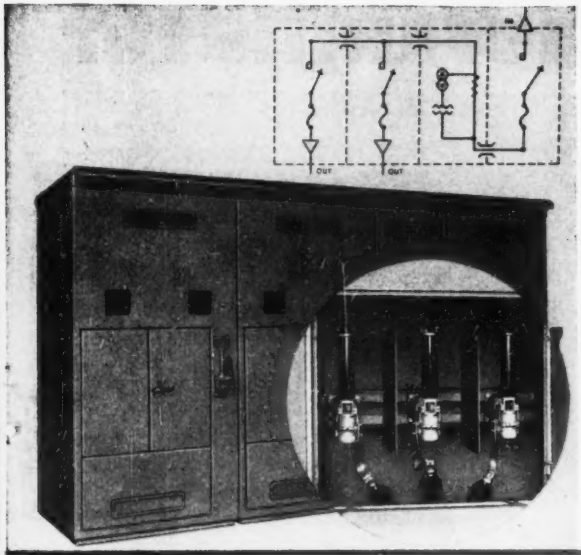
● ***Ease and Economy of Installation*** because all equipment within each unit—including meters, arresters, potheads, metering transformers, etc.—is factory assembled and connected. Incoming and outgoing connections are readily accessible.

CODE

Fuse
Disconnecting Switch
Lightning Arrester
Pothead
Meter
Through Bushing or wall opening
Potential Transformer
Current Transformer
S & C Alduti Interrupter Switch
Above 15,000 volts
15,000 volts and below

S & C ELECTRIC

Formerly SCHWEITZER & CONRAD, INC.



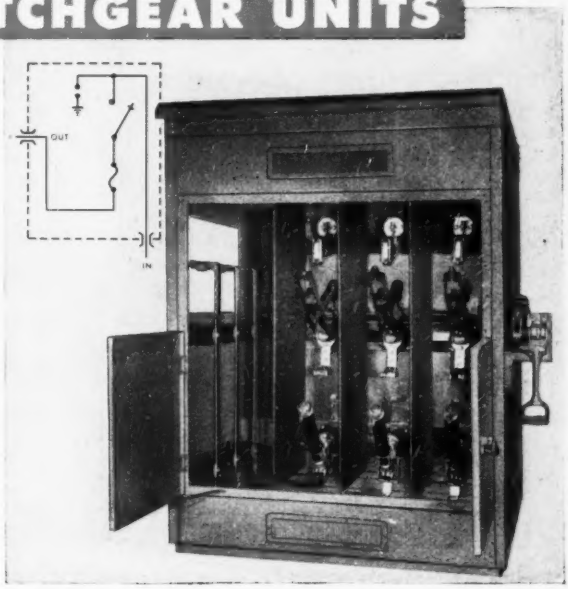
Typical Performance Characteristics of S&C Metal-Enclosed Switchgear Units:

- ***Load Current Switching***... up to 600 amperes on 2,300- to 33,000-volt circuits.
- ***Magnetizing Current Switching***... of transformer banks whose load currents are within the continuous current ratings of the switches, that is, to 1200 amperes on 2,300- to 13,800-volt circuits and 600 amperes above 13,800- to 33,000-volt circuits.
- ***Charging Current Switching*** . . . of three phase capacitor banks of 2,000 kvar on 2,300-volt circuits; and 3,000 kvar on 4,160- through 13,800-volt circuits.
- ***Short Circuit Protection*** . . . to 40,000 amperes, rms asymmetrical, on 2,300- and 4,160-volt circuits; 30,000 amperes on 13,800-volt circuits; and 20,000 amperes on 33,000-volt circuits. Or, stated in symmetrical 3-phase kva: 104,000; 180,000; 448,000; and 715,000 respectively. For higher short circuit interrupting ability, consult the factory.

ENCLOSED SWITCHGEAR UNITS

- ***Minimum Maintenance Expense*** since a blown fuse is fully restored by simple field replacement of its refill unit. Also, in the average application, the switches require just ordinary switch maintenance.

Shown here are typical units from regular production. Any special design can be made to meet your specific requirements. To get this modern, reliable, money-saving switchgear for your next installation — consult the telephone directory for the S&C representative in your city, or write us direct.

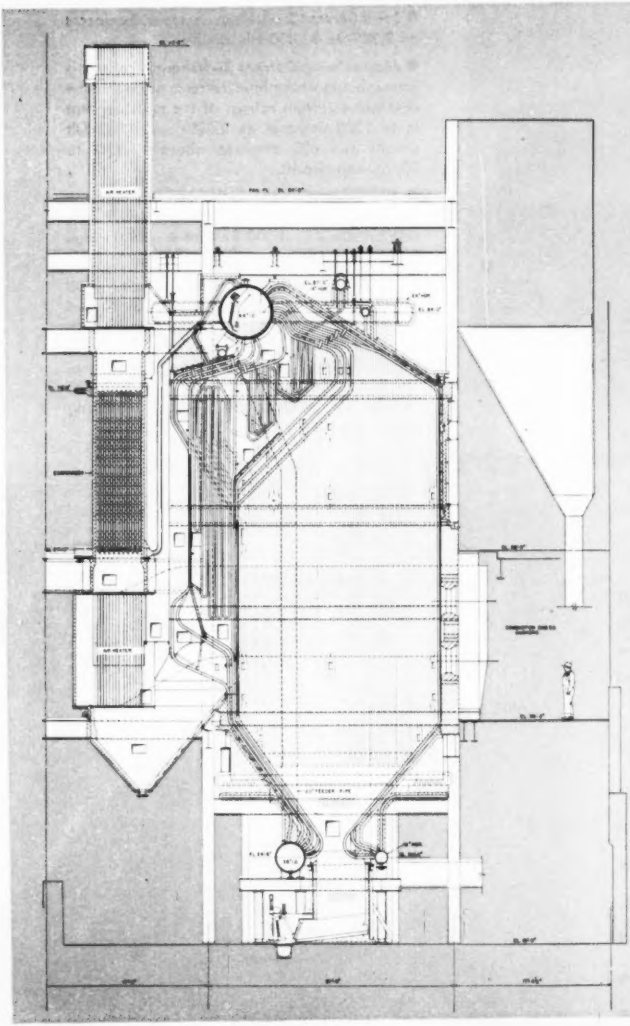


COMPANY

4421 Ravenswood Avenue
Chicago 40, Illinois, U. S. A.

In Canada, Powerlite Devices, Limited, Toronto

The new Riley units for



Central Illinois Light Co.

E. Peoria, Illinois

TWO RILEY STEAM GENERATING UNITS

300,000 lbs. of steam per hour
925 lbs. design pressure
900°F. Steam Temperature
330°F. Exit Gas Temperature
600°F. Air Temperature
85.2% Efficiency

Central Illinois Coal

Moisture	20.0%
Volatile	31.2%
Fixed Carbon	34.4%
Ash	14.4%
B.T.U.	9000

Anticipated Heat Balance

Dry Gas loss	5.42%
Hydrogen loss	3.65%
Moisture in Fuel loss	2.53%
Moisture in Air loss	.13%
Radiation loss	.47%
Unburned Combustible loss	1.10%
Leeway	1.50%
Total losses	14.80%
Heat recovered	85.20%
	100.00%

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Atlanta · New Orleans · Memphis · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

Central Illinois Light

Central Illinois Light Company, a Commonwealth and Southern property, ordered their first Riley Steam Generating unit in 1936. They ordered an additional Riley unit in 1939 and have recently placed on the line two additional Riley units as described on the opposite page. The fifth Riley unit for this station, a 600,000 lbs./hr. Riley unit is on order. Central Illinois Light has also installed a Riley unit in their Springfield plant.

Five repeat orders from this company since they installed their first Riley Steam Generating unit. A truly typical case. Almost invariably, when a company once uses Riley Steam Generating equipment they repeat for more Riley equipment when new units are installed.

This is not only because of the reliability and outstanding performance of Riley equipment but also because of the manner in which Riley handles the contract details during engineering, fabrication and erection, and because of the service co-operatively rendered after years of operation. Repeatedly, purchasers have advised us even in these difficult times "You have handled our contract more satisfactorily than any one we have ever done business with."

Is there any wonder that so many of the well-known industrial and central station companies have swung to Riley. You likewise can rely on Riley.

A Few of the many Riley Public Utility Installations

Houston Lighting & Power Co.		
West Junction Station	2-850,000 lbs./hr.	units
West Junction Station	2-400,000 lbs./hr.	units
Greens Bayou Station	2-675,000 lbs./hr.	units
Gable Street Station	1-350,000 lbs./hr.	unit
Gable Street Station	1-250,000 lbs./hr.	unit
Gable Street Station	1-140,000 lbs./hr.	unit
Public Service Co. of Indiana		
Dresser Station	1-300,000 lbs./hr.	unit
Edwardsport Station	3-400,000 lbs./hr.	units
Noblesville Station	3-300,000 lbs./hr.	units
Utah Power & Light Company		
Orem Station	1-450,000 lbs./hr.	unit
Jordan Station	1-620,000 lbs./hr.	unit
Arkansas Power & Light Co.		
Cecil Lynch Station	1-650,000 lbs./hr.	unit
City of Los Angeles		
Harbor Steam Station	3-825,000 lbs./hr.	units
Harbor Steam Station	2-675,000 lbs./hr.	units
Central Illinois Light Co.		
R. S. Wallace Station	1-600,000 lbs./hr.	unit
R. S. Wallace Station	1-375,000 lbs./hr.	unit
R. S. Wallace Station	2-300,000 lbs./hr.	unit
Southwestern Public Sevice Co.		
Borger, Texas	1-330,000 lbs./hr.	unit
Carolina Power & Light Co.		
Moncure Station	2-330,000 lbs./hr.	units
Worcester County Electric Co.		
Webster Street Station	1-325,000 lbs./hr.	unit
New Orleans Public Service Co.		
Market Street Station	1-330,000 lbs./hr.	unit
Pennsylvania Electric Co.		
Williamsport Station	1-300,000 lbs./hr.	unit
Iowa Illinois Gas & Electric Co.		
Riverside Station	3-250,000 lbs./hr.	units
Coralville Station	1-60,000 lbs./hr.	unit
South Carolina Power Co.		
Hagood Station	1-310,000 lbs./hr.	unit
Hagood Station	2-230,000 lbs./hr.	units
Mississippi Power Co.		
Plant Eaton	3-230,000 lbs./hr.	units
Gulf Power Company		
Pensacola, Fla.	2-230,000 lbs./hr.	units
West Penn Power Co.		
Milesburg Station	2-210,000 lbs./hr.	units
Ohio Edison Company		
Mad River Station	1-250,000 lbs./hr.	unit
Akron Heating Station	2-90,000 lbs./hr.	units
Interstate Power Co.		
Lansing Station	2-120,000 lbs./hr.	units
Fox Lake Station	2-120,000 lbs./hr.	units
Clinton Station	1-45,000 lbs./hr.	unit
Central Ohio Light & Power Co.		
Woodcock Station	2-120,000 lbs./hr.	units
Woodcock Station	1-90,000 lbs./hr.	unit
Woodcock Station	2-60,000 lbs./hr.	units
Otter Tail Power Co.		
Hoot Lake Station	1-160,000 lbs./hr.	unit
Crookston Station	2-75,000 lbs./hr.	units
Devils Lake Station	1-75,000 lbs./hr.	unit
Kidder Station	1-130,000 lbs./hr.	unit

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

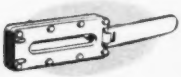
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

EASY-TO-GET-AT ACCESSORIES

Speed Inspection and Servicing

OF ALLIS-CHALMERS NETWORK TRANSFORMERS



FLUSH TYPE LIQUID GAUGE is easy to read. High impact strength tempered gauge glass is given additional protection of heavy bronze cover.

THERMAL INDICATOR shows operating temperature as well as maximum reading . . . is specially gasketed for complete waterproofing.

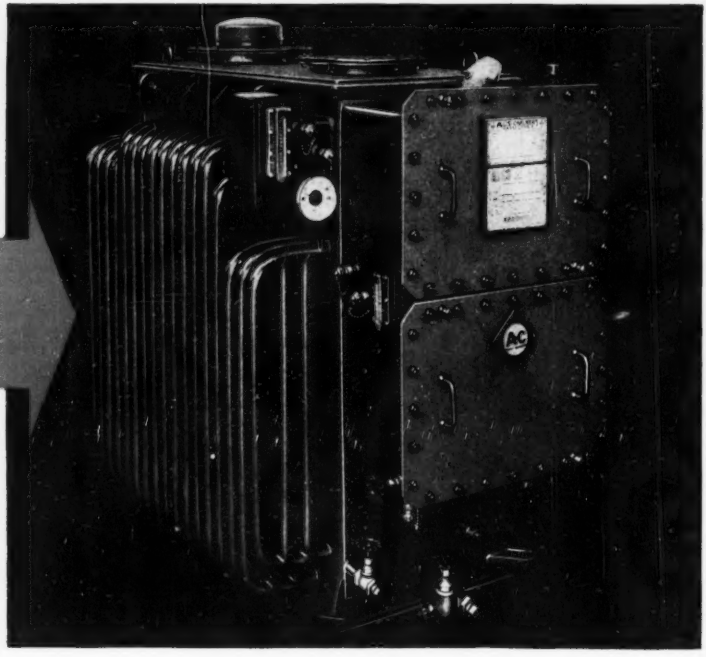
AIR TEST VALVE with spring-actuated, self-closing arrangement gives positive protection against infiltration of foreign material.

LIQUID SAMPLING DEVICE used on *Chlorextol*®-Liquid filled transformers is hand rotated to enable sample to be taken at liquid level.

TOP FILTER PRESS VALVE is located near drain valve for convenience. Internal connection is piped to diagonally opposite corner of tank, providing a cross flow to assure complete interchange of liquid.

RELIEF DIAPHRAGM on cover of *Chlorextol*®-Liquid filled transformer protects transformer in the event of abnormal operating pressure.

COMPLETE DRAIN VALVE and bottom filter press connection. Special valve design permits accurate liquid sampling.



HERE'S PICTORIAL PROOF of the convenient and logical arrangement of accessories on Allis-Chalmers Network Transformers.

Note that gauges are located for quick observation, and testing devices are placed for easy operation with a minimum of motion. All accessories are built for dependable service . . . are unaffected by corrosive atmospheres or flooding.

Careful design of accessories typifies the solid engineering — from core to case — that has built wide acceptance for A-C Network Transformers in every part of the country.

For further information, write today for bulletin 61B6152A, or contact your nearby A-C sales representative.

A-2696

ALLIS-CHALMERS, 932A SO. 70 ST. MILWAUKEE, WIS.

*Non-inflammable insulating liquid; *Chlorextol* is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Network Transformers—Nearly 1,000,000 KVA Installed

THIS IS NO YARN...

I Just Mind My Knittin' Since I Got JOSLYN CERTIFIED PROTECTION!*

This *certified protection* is achieved by the combination of a Joslyn Lightning Arrester and a simplified cutout, using the Joslyn Overload Limiter Link in a compact assembly. It can be mounted easily on any cover bushing type transformer tank. The Joslyn Lightning Arrester has proven its ability to provide Positive Protection against all effects of lightning, regardless of its magnitude or duration!

Joslyn Overload Limiters are not new. They have established an outstanding record of performance in territories where lightning conditions are most severe. And today they are protecting thousands of distribution transformers in all parts of the country, demonstrating their ability to survive heavy lightning conditions and, at the same time, to provide adequate transformer overload protection.

(*Write for the new Joslyn Certified Protection bulletin*)

***Joslyn CERTIFIED PROTECTION will save your distribution transformers:**

1. From failures or flashovers caused by lightning—even direct strokes.
2. From burnouts caused by secondary shorts.
3. And even from harmful overloads.

Branch offices in principal cities

•

THE JOSLYN CO.
THE SOUTH EAST-JOSLYN CO.
SOUTHERN JOSLYN CO.
JOSLYN SOUTHWEST CO.
JOSLYN PACIFIC CO.

JOSLYN MFG. AND SUPPLY CO.

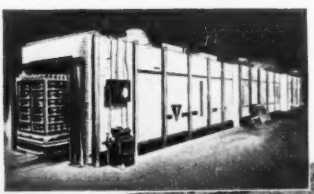
Complete Pole Line Equipment

20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

Craftsmanship and Modern Engineering

Result in

VICTOR'S Steady Growth



Kiln No. 4 Completed in 1949

Modernized VICTOR plant with over 300,000 sq. ft. of manufacturing space.

VICTOR'S skilled craftsmen, many of whom have been making high quality insulators at Victor for over forty years, take *pride* in their workmanship. It is this pride, *plus* modern ceramic and electrical engineering, *plus* advanced manufacturing equipment that have brought about Victor's steady growth.

The addition of another oil-fired tunnel kiln early this year has enabled Victor to step up the production of its high voltage porcelain insulators—insulators famous for their superior, *on-the-job performance*. And with its large modern factory, Victor is now better equipped than ever to fill your standard or special porcelain requirements.

Specify VICTOR for quality and dependable deliveries.

VICTOR
INSULATORS Inc.
VICTOR, NEW YORK

Look for this trade mark of enduring service

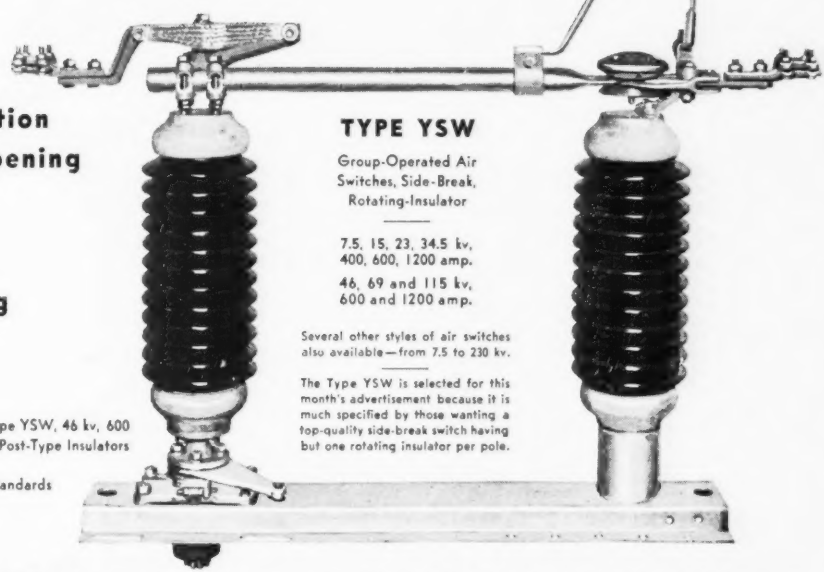
V

PACIFIC ELECTRIC
Type YSW
SWITCHES

Carry the Load through Solid-Silver Rolling Contacts

Assure Cool Operation and Easy Opening

Special Ice-Breaking Features



Showing Type YSW, 46 kv, 600 amps, with Post-Type Insulators

N E M A Standards

TYPE YSW

Group-Operated Air Switches, Side-Break, Rotating-Insulator

7.5, 15, 23, 34.5 kv, 400, 600, 1200 amp.

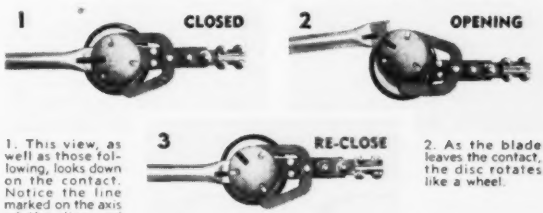
46, 69 and 115 kv, 600 and 1200 amp.

Several other styles of air switches also available—from 7.5 to 230 kv.

The Type YSW is selected for this month's advertisement because it is much specified by those wanting a top-quality side-break switch having but one rotating insulator per pole.

- Solid-silver inserts in rolling discs permit high-pressure contact (adjustable up to 80 lb), yet assure easy opening or closing.
- Floating self-aligning roller-contact design, as illustrated, assures easy operation, always.
- Ice is broken progressively because discs swivel sideways before starting to rotate.
- Rotating insulators have widely spaced ball or roller bearings with weather shields. All parts non-ferrous above insulator caps.
- Operating linkage for 3- or 6-pole switch has stainless-steel pins and mostly anti-friction sleeve or roller bearings.

How the Exclusive Rolling Contacts Reduce Friction, "Run" Cooler, and Assure Easier Operation



1. This view, as well as those following, looks down on the contact. Notice the line marked on the axis of the disc and blade.

2. As the blade leaves the contact, the disc rotates like a wheel.

3. The next time the blade enters contact, an entirely new contact position is presented to the blade.

Get All Facts . . .

Send for Catalog 130

Call

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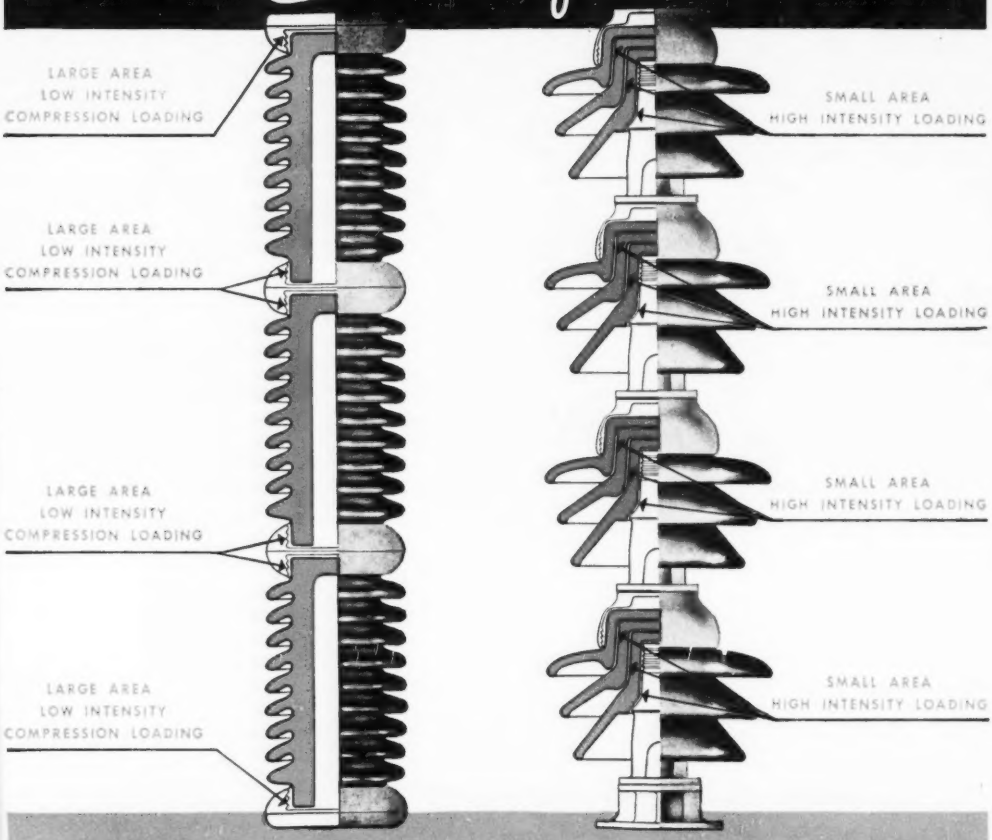
617 Mutual Bldg., Richmond 19, Va.
LEONARD M. SLUSSER, 318 Dooly Block, Salt Lake City 1, Utah

Other Representatives in Principal Cities

✓✓ Compare!



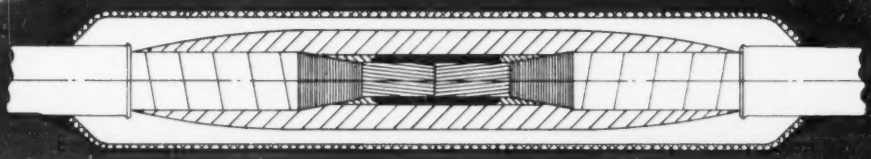
Mechanically and Electrically LAPP STATION POSTS Are The Choice For Switch and Bus Support At 115-161 Kv.

Shown above are a Lapp Station Post for 138-161 Kv, and a conventional pin-type station insulator of the same voltage. From the standpoint of rigidity and permanence compare the Station Post's six large-area low-intensity compression-loading cemented joints with the other design—twelve small-area high-intensity nested-porcelain joints. Which design do you think has the best chance of survival under stresses from thermal change, under torsion load, cantilever load and impact? Why would anybody specify the pin-type design when he can get the security of Lapp Station Posts—up to 161 Kv?

Lapp STATION POSTS

LAPP INSULATOR CO., INC. • LE ROY, N.Y., U. S. A.

YOU SAVE TIME AND MONEY!



when cables are spliced with G&W SPLICING KITS...

THESE BULLETINS ARE YOURS ON REQUEST—
Send for them today!

BULLETIN CJ1 — lists 2-way Var. Cam., Lead Covered 1/c, 3/c and 4/c *Belted* cable joints.

BULLETIN CJ2 — lists 2-way Var. Cam., Lead Covered, 3/c *Shielded* cable joints.

BULLETIN CJ3 — lists 2-way Paper, Lead Covered, 1/c and 3/c *Belted* cable joints.

BULLETIN CJ4 — lists 2-way Paper, Lead Covered, 3/c *Shielded* cable joints.

BULLETIN CJ5 — lists 2-way Rubber, Lead Covered, 1/c, 2/c, 3/c and 4/c cable joints.

BULLETIN CJ6 — lists Rubber Insulated, Neoprene Jacketed 1/c and 3/c cable joints and terminations.

BULLETIN CJT — lists Telephone and Signal cable joints.

Standard and special 3-way Y cable splicing kits for any type of cables will be quoted on request.

In Unit Packages for Convenience!

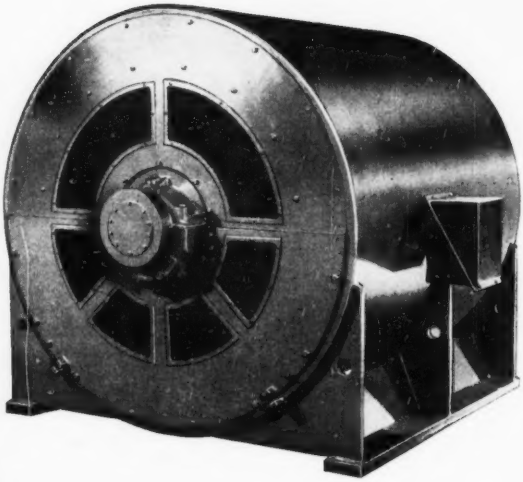
G&W ENGINEERS have accumulated years of experience in the design and installation of cable joints for all sizes and types of cables. This long experience has provided G&W with a wealth of engineering data with which to establish standards for making the best possible cable joints. Extensive laboratory testing and years of actual field service of cable joints have thoroughly proved these standards. Thus, when cables are spliced according to G & W recommendations, you *know in advance* that the design is correct and the performance dependable.

G & W has developed splicing kits—*unit packaged for convenience*—for ALL types of cables and joints (except gas or oil filled high voltage). Each splicing kit contains all required materials neatly packed in a unit package . . . each item in the correct quantity for a properly designed joint. You save time and expense of securing materials needed from different sources or from inventory. No waste—accumulation of dead stock is eliminated. All materials kept clean, ready for use. By using G & W Unit Package Splicing Kits you can determine actual cable splicing costs quickly, accurately.

G&W Unit Package Cable Splicing Kits Are Endorsed by Leading Cable Manufacturers

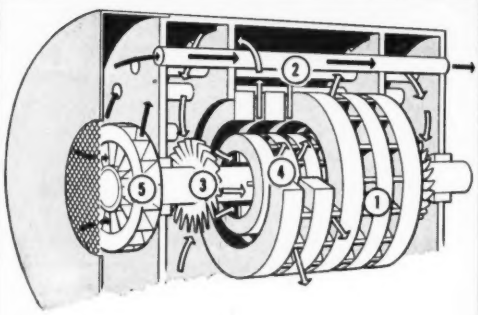
G&W ELECTRIC SPECIALTY COMPANY
7780 DANTE AVENUE, CHICAGO 19, ILLINOIS, U. S. A.
In Canada — POWERLITE DEVICES, LTD., *Toronto*

TUBE-TYPE
TOTALLY-ENCLOSED FAN-COOLED MOTORS!



INSTALL INDOORS or OUT!

How Tube Cooling Works



Stator core (1) is surrounded by tubes (2). Internal fans (3) circulate air through ducts (4) in rotor and stator and around tubes, transferring heat to tubes.

External fan (5) drives outside air through tubes, removing heat and keeping tubes clean. All electrical parts are enclosed. Dirt cannot enter.

- **Dirt-proof and corrosion-resistant**
- **Heat exchanger is practically *self-cleaning***
- **Simple self-contained cooling system—sizes from 75 to several thousand horsepower**

WHEREVER DUST, DIRT, fly ash, rain and snow, smoke, or corroding fumes keep motor maintenance costs high, this Allis-Chalmers tube-type motor will cut maintenance sharply.

All electrical parts—including stator core—are enclosed. Simple heat transfer system keeps temperatures well within rated limits. Cleaning is rarely needed because air passages are unrestricted. Air flow through the straight tubes removes foreign matter.

Important savings have been proved in three years of field operation. Sizes from 75 hp and up. Also explosion-proof designs. For complete information, outline your requirements to your A-C Sales Office, or write for Bulletins 05B7150 and 51R7149.

A-2610

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

1. **Long Life**

The Anhydrex and neoprene compounds used in the manufacture of ANHYDROPRENE Cables are formulated to provide lasting resistance to aging, as shown below.

Minimum Values	Anhydrex Insulating Compound			Neoprene Jacket Compound	
	Original Test	After 10 Days at 80°C. in Water	After 7 Days at 121°C. in Steam	Original Test	After 10 Days at 80°C. in Water
Tensile — Lbs. per Sq. Inch	900	700	700	1800	1800
Elongation — at rupture, Percent	450	300	300	300	250
Modulus — Lbs. per Sq. Inch at 200% Elongation	400	—	—	900	—

2. **Moisture Resistance**

Simplex guarantees that its Anhydrex insulation will not absorb more than 20 mg. of water per square inch of exposed surface after 7 days immersion in water at 70°C. (158°F.). This is called a mechanical water absorption test. There is another test of equal importance called electrical stability in water. When subjected to this test, Anhydrex insulation will meet the following test requirements. The dielectric constant will not exceed 3.2 after one day's immersion in water at 70°C. (158°F.). The increase of capacitance between one day's and eight days' immersion in water at 70°C. (158°F.) will not exceed 3.5% for insulation thicknesses greater than 4 64" or 5% for insulation thicknesses of 4 64" or less. After the sample has been immersed in water for eight days at 70°C. (158°F.) the power factor will not exceed 1%.

3. **Abrasion Resistance**

Tests and service records show that a properly-compounded neoprene jacket, such as is used on ANHYDROPRENE Cables, will take — without interference with service — even more physical abuse than the best natural rubber compound.

4. **Resistance to Oil, Heat, Sunlight and Flame**

The neoprene jacket on ANHYDROPRENE Cables will not support combustion. It is not affected by exposure to sunlight and resists deterioration from oil and heat.

5. **Resistance to Acids, Alkalies and Corrosive Chemicals**

When exposed to the acids, alkalies and corrosive chemicals usually found underground in ducts, the neoprene jacket can be depended upon for a long service life.

6. **Elimination of Electrolysis Resistance to Stray or Secondary Currents**

Having no metallic coverings, ANHYDROPRENE Wires and Cables are not subject to electrolysis. They effectively resist stray or secondary currents, do not have to be bonded, and require no special grounds.

7. **Light Weight and Small Diameter**

Because of its light weight and small diameter, long lengths of Simplex-ANHYDROPRENE can be easily handled in the field by small installation crews.

8. **Flexibility**

The flexibility of ANHYDROPRENE Cables exceeds that of cables having metallic or fabric coverings. This flexibility facilitates racking and makes for easier pulling into ducts or conduits.

9. **Elimination of Duct Lubricants**

Because of the smooth surface of the neoprene jacket, ordinarily no oil or grease lubricant is necessary at the time of installation in or removal from ducts. Flooding the duct with water will usually provide sufficient lubrication. ANHYDROPRENE Wires do not clog or "freeze" in ducts and can be pulled out and reinstalled even after years of service.

10. **Easy Termination**

Being moisture resistant, ANHYDROPRENE Wires and Cables may be terminated without potheads. A waterproof taping with drip loops is all that's required.

11. **Easy Jointing and Taping**

As ANHYDROPRENE is extremely simple in design, it requires but a minimum of jointing and tapping materials, tools, and labor. Conductor splicing tools, a sharp knife, rubber cement, rubber splicing compound, tape and waterproof paint are all that are necessary to joint or tap.

12. **Markings**

The name "Simplex - ANHYDROPRENE" is molded or stamped on the jacket. In addition, identification marks, letters, or figures may be included so that phases, circuits, etc. can be readily identified without destruction of the cable or the use of metal tags.

Page 2 of the new Simplex Bulletin 115 lists twelve big reasons why Simplex-ANHYDROPRENE Cables can be relied upon for low-cost installation, trouble-free service and long life. They are twelve of the many advantages these cables provide through the combination of Anhydrex insulation and a neoprene jacket.

Yet even they are only a part of the valuable information this bulletin contains. You ought to know about it for it shows the way to low-cost, thoroughly-dependable transmission and distribution systems.

If you're not up-to-date on ANHYDROPRENE Cables, or are not aware that a cable consisting only of conductor, insulation, and a thin jacket can provide the electrical stability, mechanical toughness, and versatility that efficient systems demand, it will pay you to read Bulletin 115. Why not drop us a line today for your copy?

Simplex — **WIRES & CABLES**

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

Lifetime protection for Life Lines UNDERGROUND

UTILITY COMPANIES—to maintain reliable and constant service for customers—need *permanent* protection for cables, the underground *life lines* of their modern distribution system.

1. Protection from Cable Sheath Abrasion.
2. Protection from Pulling Tensions.
3. Protection from Corrosion.
4. Protection with Cable Movement.

For over 50 years the Electrical Industry has used **ORANGEBURG CONDUIT** to safeguard cables *underground* . . . to help assure the uninterrupted flow of vital current to industry, office, farm and home.

On inspection—after 50 years underground—**ORANGEBURG CONDUIT** *reveals* its original high quality . . . reflects the unique toughness and strength of its materials, their *permanent* resistance to corrosive ground waters and chemical wastes. *Other advantages* . . . easy to handle, transport, install . . . low initial and maintenance costs.

For more complete information write today for **ORANGEBURG** Catalog No. 49. Keep it for ready reference in your files.

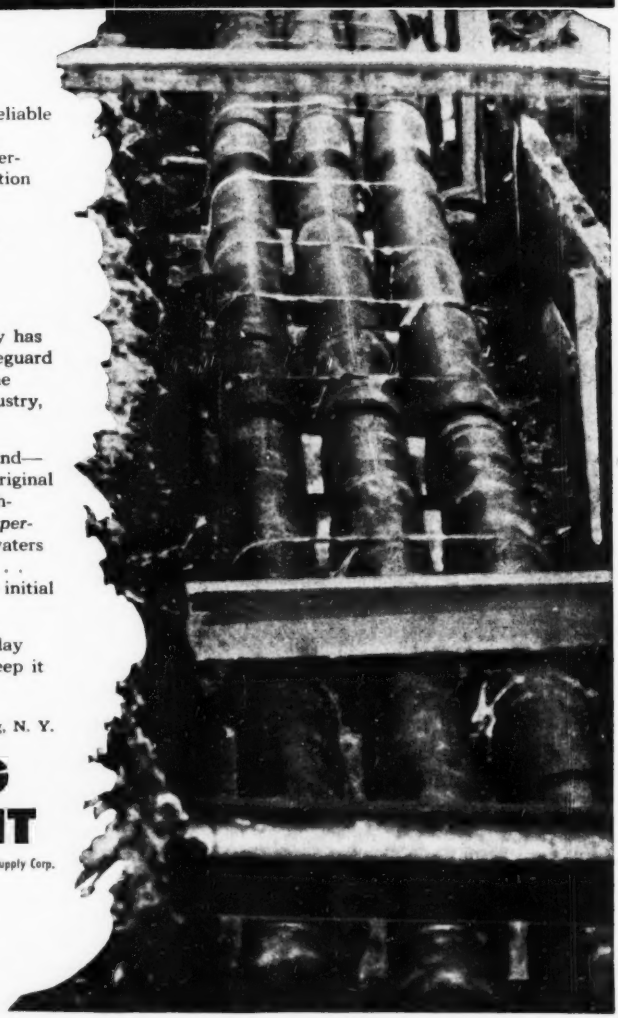
Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

ORANGEBURG FIBRE CONDUIT

Graybar Electric Co., Inc. • Distributors • General Electric Supply Corp.

CONDUIT REG. U.S. ORANGEBURG PAT. OFF. PIPE

ORANGEBURG STANDARD
For installation with concrete encasement.



"MK-40" Advanced Design Features Offer—

"MK-40" Single-pole Unit; 115 Kv, 600 A.

PEAK PERFORMANCE—NEW OPERATING EASE—LOW INSTALLATION COST

All the qualities for years of trouble-free operation are inherent in the design of Delta-Star "MK-40" group operated switches. They offer all-around simplicity and ruggedness; improved contact design; minimum number of moving parts; powerful blade actuating mechanism; low installation cost. You will appreciate their smooth operation.

The fully controlled blade is actuated by a 45-degree bearing mechanism employing only three moving parts. Blade is turned free of contacts and simultaneously raised to a vertical position . . . locks automatically in opened or closed positions.

Improved, high pressure, silver to copper contacts at both ends of the one-piece blade offer a direct low resistance current path from terminal to terminal. Contact pressure is maintained by independent, fatigue resistant, beryllium copper springs which carry no current. Ample material for heat dissipation assures high thermal conductivity.

Threadless pipe fittings on the operating mechanism permit installation and alignment in a minimum of time. Fittings have self-piercing set screws which actually pierce the pipe to make final adjustment permanent.

Available in ratings from 7.5 to 230 Kv. and 400 to 5000 amperes; for upright, vertical or inverted mounting.

Ask for Publication 4807

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CANADIAN ASSOCIATE
Canadian Line Materials Limited — Toronto 13, Canada

Be specific – Don't just

TYPICAL TEST RESULTS ON RUBBER COMPOUNDS

Use this table

The tabulation below lists representative values that have been obtained in actual tests of these rubber compounds.

PROPERTIES AND TESTS		REPRESENTATIVE TEST VALUES FOR VARIOUS COMPOUNDS						
		AMARINE —40	AMERZONE —0	AMERZONE —8	AMARINE —RWS	AMERITE	AMPEROX	AMERPRENE
BASIC TYPE OF INSULATION		Natural Rubber	Oil-base	Butyl Rubber	Synthetic Rubber	Commercial 30%	Heat-Resistant	Polychloroprene
MAX. REC. COPPER TEMP.		60°C	75°C	80°C	75°C	60°C	75°C	80°C
ELECTRICAL CHARACTERISTICS	Dielectric Constant (Spec. Ind. Cap.)	4.0	4.0	4.0	4.5	4.5	4.5	....
	Ins. Res. (K)	50,000	7,500	40,000	30,000	30,000	20,000	100
	Dielec. strength in volts per mil	450	350	300	400	400	350	200
PHYSICAL PROPERTIES	Tensile Strength in lbs. per sq. in.	2000	600	700	950	1000 Synth. 1500 Nat.	1000 Synth. 1800 Nat.	2000
	Elongation in 2"	450%	300%	400%	450%	500%	500%	500%
	Permanent set	¼"	½"	⅜"	⅜"	¼"	¼"	¼"
ACCELERATED AGING	Type of test	Geer Oven	Geer Oven	Geer Oven	Oxygen Bomb	Geer Oven	Oxygen Bomb	Geer Oven
	Temperature	70°C	80°C	100°C	80°C	70°C	80°C	80°C
	Hours	288	168	672	168	504	336	168
	% Original Tensile Strength	70%	80%	80%	80%	85%	80%	90%
MOISTURE RESISTANCE	Gain in wt. after 7 days immersion at 70°C (Mg. per sq. in.)	25	....	20 or less	15 or less	35	35	30-60
	Capacity increase after 4 weeks immersion at room temperature	15%	15%	15%	10%	15%	15%	....
	Stability Factor 40-80 volts per mil 2 weeks at 50°C	.5%	1.5%	1.0%	.8%	2.0%	3.5%	....
SPECIAL PROPERTIES		High Voltage and Submarine use	Meets IPCEA ozone test	Withstands .03 conc. 10 hours	For hot and moist locations	General purpose rubber insulation	General purpose rubber insulation	Resistant to oil, flame and ozone

As the test data vary considerably with different sizes of conductor and thicknesses of insulation, these identical results can not be guaranteed throughout the whole range of sizes and voltage ratings. Some specific constructions will test higher and others will test lower than the listed values. However, the above table indicates in general what may be expected of these compounds.

AMERICAN STEEL & WIRE COMPANY

say Rubber

for detailed specifications

THE buyer of rubber-insulated cable today is faced with the dilemma of choosing between natural rubber, synthetic rubber, and a dozen different compounds of each.

The American Steel and Wire Company has always advocated the use of special rubber compounds to meet special requirements. To help you choose the right rubber compound, we recommend that you—

Specify	*For*
AMARINE-40	High voltage service under ground or under water, for all submarine power cables and for general use above 7500 volts.
AMERZONE	Ozone-resistance. Amerzone-0 is an excellent oil-base compound. Amerzone-B is a butyl rubber compound that is highly resistant to heat and moisture as well as to ozone.
AMARINE-RWS	Hot or damp locations. This is a compound notable for having low water absorption combined with excellent heat resistance.
AMERITE	General use up to 7500 volts. A compound of the performance type recommended for use where copper temperatures will not exceed 60°C (140°F).
AMPEROX	General use up to 7500 volts where a heat-resistant compound is required for operation at copper temperatures up to 75°C (167°F).
AMERPRENE	Flexible jackets. Owing to its high content of Neoprene, this compound is resistant to oil, flame and sunlight.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

The accompanying illustration shows one of our standard constructions with Amerite Performance Grade around conductors; conducting rubber tape for non-metalic shielding when rated over 2000 volts. The cover is of Amerprene, a tough, hard-wearing compound, containing a high percentage of Neoprene. These compounds can be combined in cable constructions to fit the requirements of industrial, mining, and submarine installations.

USS

AMERCLAD CABLES

UNITED STATES STEEL

CROUSE-HINDS

Crouse-Hinds
1950 Model
Sports Light
. . . Type FLA

1950 Model

Sports Light

. . . embodies all the latest scientific advances in floodlight design . . . improvements that give you more light and easier maintenance

1. The two-piece *Alzak reflector gives more light.
2. The stream-lined aluminum head and body give greater strength.
3. The hinged body makes relamping quick and easy and keeps the entire floodlight in a single unit at all times.
4. The extra large opening insures a quicker and better job of cleaning the interior.
5. The floodlight can be tipped over for convenient cleaning of the cover glass, and when returned to its original position, a stop insures perfect alignment.
6. The spun-in cover glass is both heat and impact resisting.
7. Degree markings and a sight for accurate aiming save installation time.
8. Crouse-Hinds' high standards of quality and skilful workmanship insure long life.

Crouse-Hinds' latest sports lighting bulletin contains NEMA standard plans for the lighting of baseball, football, and softball fields. Many minor sports are also included. Send for your copy today.

Alzak is the registered trade mark of the Aluminum Company of America

A Nationwide Distribution Through Electrical Wholesalers

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FLOODLIGHTS • AIRPORT LIGHTING • TRAFFIC SIGNALS • CONDULETS

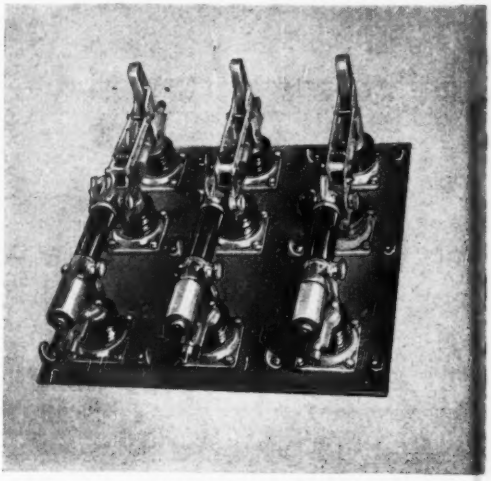
The THRIFTY SWITCH

It is no longer necessary to use expensive oil switches or circuit breakers to perform many high voltage switching operations. The new Three E Air Interrupter Switch capable of performing these operations has been thoroughly tested in laboratory, as well as in actual service, before being offered to the electric power Industry.

Here is some of the things it will do:

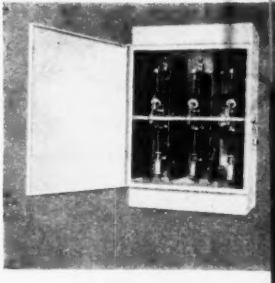
1. **Open full rated load current at full rated voltage of switch.**
2. **Open magnetizing current of transformers.**
3. **Open charging current of buses, lines and cables.**
4. **Open exciting current of feeder regulators.**
5. **Sectionalize feeders and distribution circuits.**
6. **Switch charging currents of capacitor banks.**

In the opening operation of this type of switch, the arc is confined and interrupted in an arcing chamber by gases produced by action of the arc on solid material. No oil, air blast or other medium is employed. Furthermore, the switch when open provides a visible air gap. When it is reclosed the arcing contacts close first and the switch automatically resets for the next opening.



3 P.S.T. 400 ampere 7500 volt type GF 1W-1 Switch and Power Fuse less operating mechanism and barriers.

When combined with power fuses as illustrated herewith it provides an inexpensive means not only for non-automatic circuit switching but also for overload and short circuit protection.



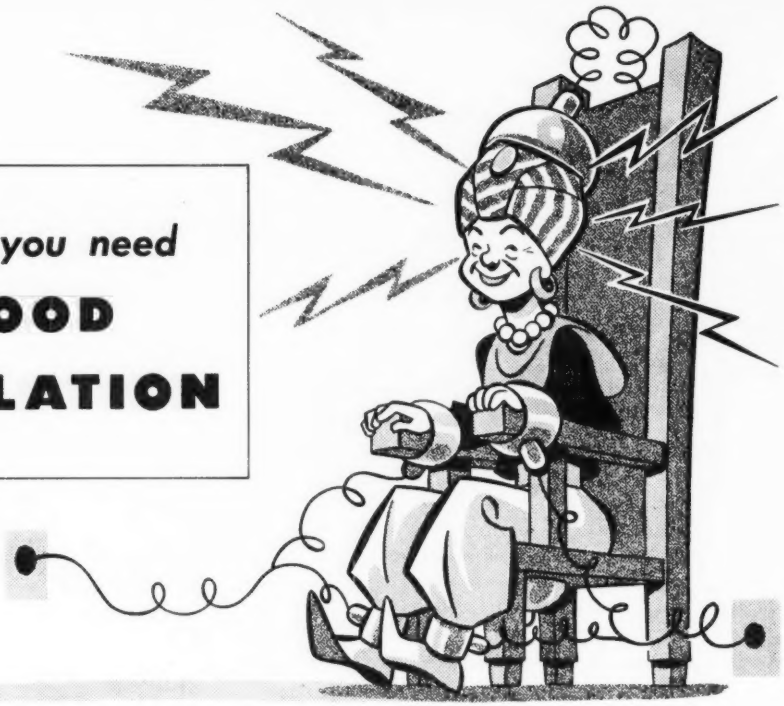
Same equipment with operating mechanism and barriers, metal enclosed.

Bulletin 141 lists indoor air interrupter switches up to 600 ampere and 15000 volt. Send for it.

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS

when you need

GOOD INSULATION



. . . to make your product sell and serve, you have only two choices so far as mica goes . . . ordinary mica, and MACALLEN MICA. And—because it is easy and economical to say MACALLEN, and hard and expensive to right the engineering wrongs that poor mica brings, you'll find that most canny production and purchasing men are forgetting that there's such a thing as plain, everyday mica. Just check on those electrical products that lead the reputation parade. You'll find that they are MACALLEN MICA insulated—one good name helping another.

PRECISION . . .

Many engineers never connect precision with mica processing—until they become acquainted with MACALLEN MICA, with its accuracy of shape, thickness, flexibility and other qualities. Do you know it?

MACALLEN MICA

ALL FORMS, ALL QUANTITIES — ALL DEPENDABLE

when you think of MICA, think of MACALLEN

THE MACALLEN COMPANY 16 MACALLEN STREET • BOSTON 27, MASS
CHICAGO: 565 W. WASHINGTON BLVD. • CLEVELAND: 1231 SUPERIOR AVE

SQUARE D's *New*

SAFETY SWITCHES

*Types A, C and D

Backed by 40 years' DESIGN LEADERSHIP

The remarkable superiority of this new switch line is reflected in these TYPE A design and operating features:

MODERN STYLING is both functional and attractive.

COMPACTNESS obtained without sacrifice of wiring convenience.

FULL COVER INTERLOCK has attachment that locks switch "ON" or "OFF" with 1, 2, 3 or 4 padlocks of nearly any size or shape.

SIMPLE MECHANISM—quick make-and-break action—no dead center.

SILVER-PLATED current-carrying parts.

EXPOSED BLADES permit visual checks of switch operation.

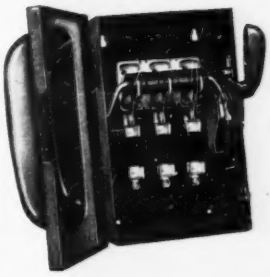
DEAD-FRONT line terminals are protected by hinged arc chamber cover.

MAGNETIC ARC PLATE adds to unusually high rupturing capacity.

POSITIVE PRESSURE jaws and fuse clips, steel reinforced, silver-plated.

NON-TRACKING insulation used in base. Melamine insulating cross-bar.

REMOVABLE PRESSURE CONNECTORS permit substitution of solder lugs, where preferred.



*Types **C** and **D** similar to Type **A** in appearance—differ in construction details*

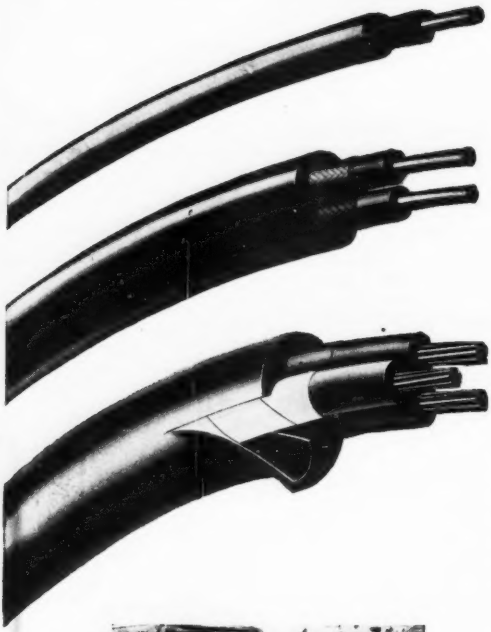
In production: 30 and 60 ampere sizes ...**NOW** · 100 and 200 ampere sizes ...**SOON** · Larger ampere sizes ...**LATER**

***Write** for Bulletin 3100 • Square D Company, 6060 Rivard Street, Detroit 11, Michigan*

SQUARE D COMPANY

DETROIT · MILWAUKEE · LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.



Choose One Type of Power Cable... Use it Three Ways

Pick Durasheath for power distribution: small size or large . . . one, two or three conductors . . . to carry from 0 to 5,000 volts. Then use this type in any installation you like: buried directly in the ground . . . in conduit . . . suspended from poles . . . or in a run that includes all three. Following are some of the characteristics of Durasheath that give it this versatility:

Durasheath is *unaffected by electrolysis*, corrosion and extremes in temperature.

High resistance to oil, flame, abrasion, cutting, impact and the moisture, acids and alkalies found in the soil.

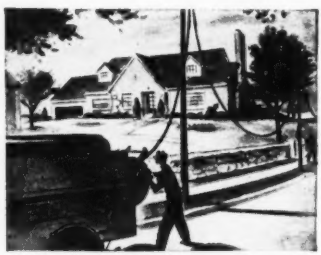
Light weight – greater strength.

More flexible, easier to handle.

For power distribution between industrial plants, in street lighting systems, airports, mines, railroad signal systems, farm buildings and real estate developments – to mention a few – use Durasheath, the all-purpose cable. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 49422

UNDERGROUND. Toughness of neoprene jacket assures long life of Durasheath when installed directly in the ground.

IN DUCT. Moisture, oil, acid resistance of neoprene jacket make Durasheath an ideal cable for this application.



IN THE AIR. In single or multi conductors, Durasheath truly is a one-type cable for all-type use.

Anaconda **Durasheath**

ANACONDA

THE ALL-PURPOSE CABLE

PROOF that you get

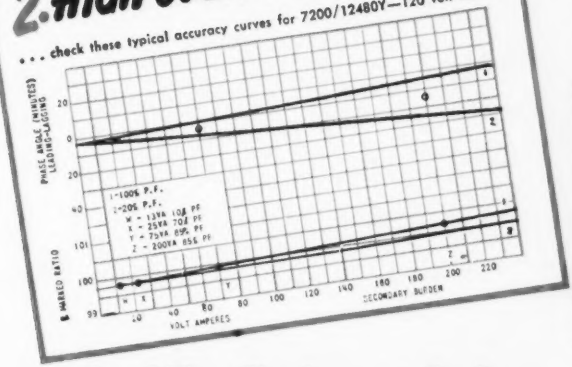
1. HIGH THERMAL CAPACITY

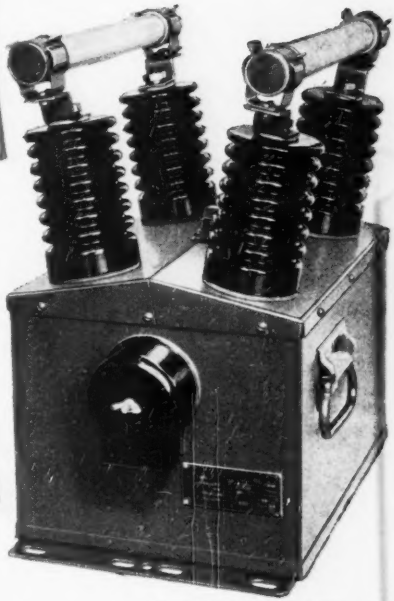
. . . thermally capable of supplying several times nominal rating continuously!

Voltage	Nominal Rating	Thermal Capacity
240 to 2400	200 VA	500 VA
4800 to 7200 (line to line)	200 VA	600 VA
7200 (line to neutral) to 14,400 v.	200 VA	1000 VA

2. HIGH OVERALL ACCURACY

. . . check these typical accuracy curves for 7200/12480Y—120 volt rating.





Type PD potential transformer with current limiting fuses, rated 14400 — 120 volts.

with Allis-Chalmers Indoor Potential Transformers

Unit at left is rated 14400 — 12 volts; unfused.

Rating of PD transformer at right is 2400 — 120 volts; unfused.

RESERVE THERMAL CAPACITY and uniformly low phase angle and ratio errors are among the first qualities you demand in potential transformers.

They're qualities you GET when you specify Allis-Chalmers type PD's!

One of the reasons is A-C's "balanced design." Materials are distributed in such a manner as to obtain closely balanced characteristics over the entire operating range. This, plus built-in high thermal capacity makes type PD transformers ideal for heavy duty, accurate metering service.

Proof of these claims is offered in the charts above.

For complete information on design, construction and mounting features, contact your nearby A-C sales representative.

Or write direct for new Instrument Transformer bulletin 61B7168, listing over 400 types and ratings.

A-2808

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization

2,800,000 Lb Per Hr of Controlled Superheated Steam

Produced in One Station by Foster Wheeler Twin Furnace Steam Generators

Slag-free Operation

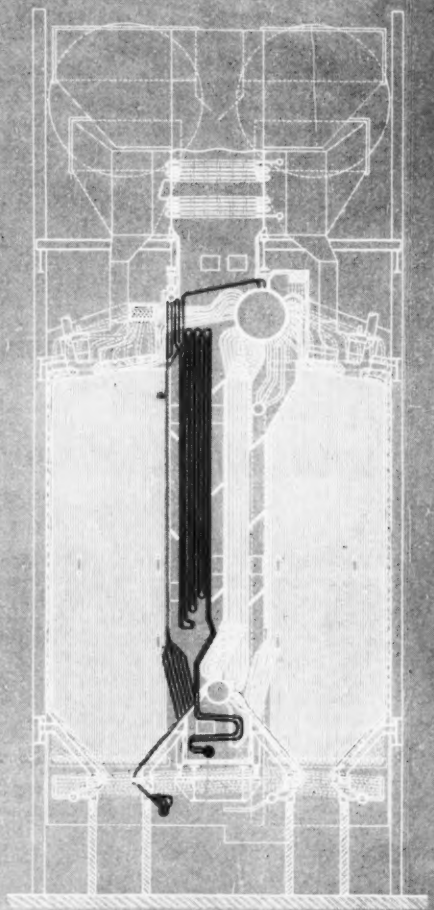
Furnace exit gas temperatures of high capacity, high pressure, high steam temperature units are established by the slagging characteristics of the fuel fired. The Twin Furnace design provides approximately 30% more cooling surface than a single furnace unit having similar furnace proportions.

Controlled Final Steam Temperature

By judicious proportioning of the surface of the radiant superheater located in one furnace and the convection superheater, a desirable flat characteristic steam temperature curve may be attained. Further control is obtainable by differentially firing the two furnaces thus stabilizing steam conditions for optimum turbine efficiency over the widest possible operating range.

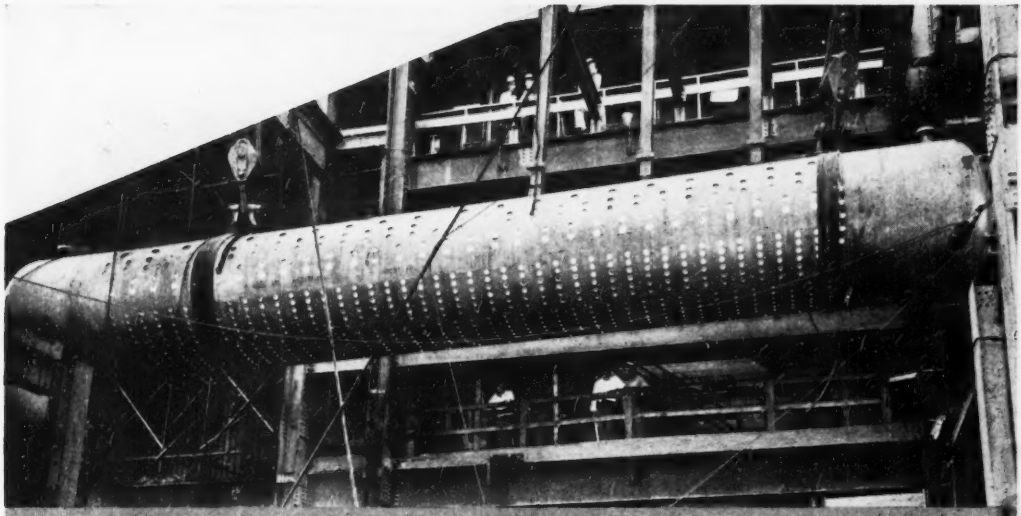
Compact Design

Substantial saving in building space is achieved through the use of smaller permissible furnace volumes with increased cooled wall area distributed in two furnaces and by compact arrangement of all component parts of the unit.

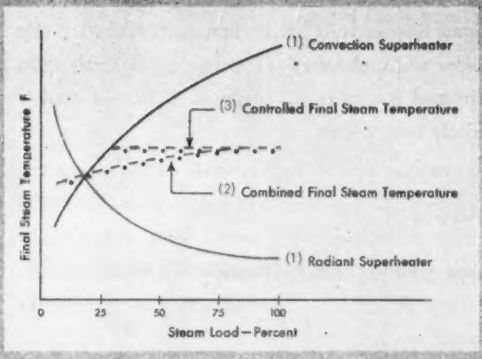


Duquesne Light Company
Phillips Power Station
Pittsburgh, Pennsylvania

Steam capacity	600,000 lb per hr
Superheat control range	270,000 to 600,000 lb per hr
Pressure superheater outlet	900 psi
Final steam temperature	900 F
Bituminous Coal Pulverized in FW Ball Mills	



An upper steam drum being placed in position at Unit No. 2 of the Phillips Power Station of the Duquesne Light Company.



Curves showing final steam temperature

(1) Convection and radiant superheaters operating independently

(2) Twin Furnace combination radiant and convection superheater

(3) Controlled differential firing at lower partial loads, minimizing the need for special temperature control equipment.

A total of 5 Twin Furnace steam generators—designed, engineered, and constructed by Foster Wheeler—will be installed at the Phillips Power Station of the Duquesne Light Company which serves a large area in and around Pittsburgh, Pa. Two are already in service and three are on the way. This station, which will generate 237,000 kilowatts when completed, is part of a system covering a territory populated by some 1,500,000 persons.

Growing preference for this ideally balanced design is evidenced by the fact that other large utilities are now using Foster Wheeler Twin Furnace steam generators. The Twin Furnace arrangement with combination radiant and convection superheater permits constant final steam temperature through exceptionally wide load ranges.

FOSTER WHEELER CORPORATION 165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

CHECKING COSTS?

THEN CONSIDER REYNOLDS ACSR

REYNOLDS CABLE PROGRAM ASSURES YOU A DEPENDABLE SUPPLY OF THIS ECONOMICAL CONDUCTOR

IF you're examining your costs on new line construction, it will pay you to investigate Reynolds ACSR. Its first cost is substantially lower than copper. Now add such other advantages as high strength, less sag, longer spans and faster, easier erection. Result—a quality installation for definitely less money.

What's more, you can standardize on Reynolds ACSR assured of the fact that you can get continuing on-schedule deliveries. Reynolds cable program has been developed on a sound, long range basis. ACSR is a permanent member of the Reynolds product family. Metal, machinery and manpower have been allocated for producing cable in ever increasing quantity.

Whether your cable requirements are large or small, Reynolds welcomes your inquiry. For prices and product information, call the Reynolds field office listed under "Aluminum" in your classified telephone directory. Or write to address below.

New ACSR Manual for Engineers

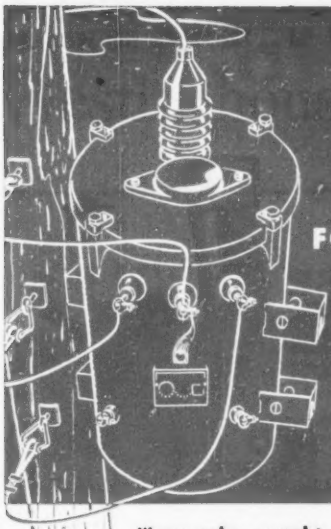
Sag tension charts, staking tables, stringing-sag tables, data on line design and erection—this and other valuable data are contained in this complete manual. Free when requested by letter.

IF YOU SEE RUST YOU KNOW IT'S NOT ALUMINUM

REYNOLDS metal

REYNOLDS *Lifetime* ALUMINUM

CONSIDER ALUMINUM — CONSULT REYNOLDS — THE COMPLETE ALUMINUM SERVICE

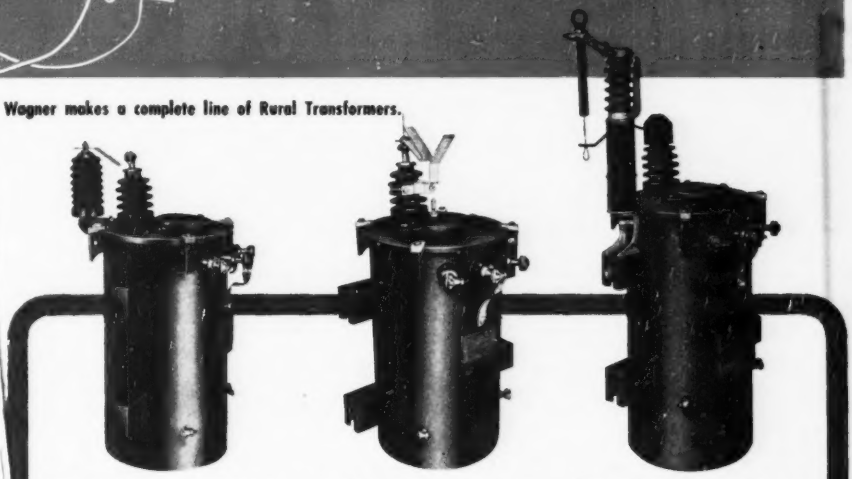


choose a Wagner rural-line Transformer

FOR INCREASED SYSTEM EFFICIENCY

Expert engineering, skillful workmanship and precision manufacture give Wagner Rural-Line Transformers the ability to provide the kind of satisfactory, continuous operation that reduces maintenance costs and consumption losses to a minimum. They have established *proven* service records in the field and support the enviable reputation of Wagner Transformers.

Wagner makes a complete line of Rural Transformers.



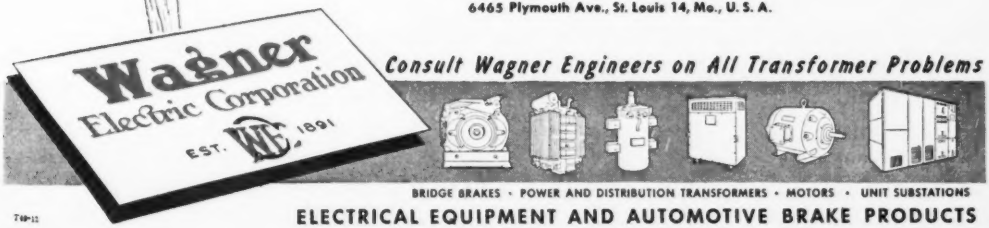
Type HEF-3—De-Ion Gap on high-voltage side provides surge protection; secondary circuit-breaker protects transformer against secondary short-circuits and overloads. Breaker reset handle is easily accessible; on sizes 5 kva and above, a warning signal light is built into the reset handle.

Type HEF-5—Double "bird-proof" gap provides surge protection; internal fuse forms a protective link between the transformer and the high-voltage line to prevent "line lockout" if the transformer is damaged in operation. When double gap and internal fuse are combined no other surge protection or transformer fuses are required.

Type HEF-7—Equipped with a Joslyn Lightning Arrester to provide surge protection and a primary overload limiter link, which is an "extended range" link, that withstands momentary surges even in fractional ampere ratings, yet protects the transformer against harmful overloads and secondary faults. A blown fuse can be quickly replaced, reducing the time required to put the transformer back in service.

For further information on Wagner Rural-Line Transformers, write for Bulletin TU-1C.

Wagner Electric Corporation
6465 Plymouth Ave., St. Louis 14, Mo., U. S. A.



Consult Wagner Engineers on All Transformer Problems

BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL EQUIPMENT AND AUTOMOTIVE BRAKE PRODUCTS

T49-11

From Newark, Ohio...
More Kaiser Aluminum Cable!

More than anything we could say, the above picture illustrates the rapidly increasing shipments of Kaiser Aluminum Cable produced by Permanente Metals.

First deliveries were made from centrally located Newark, Ohio last June — *three months ahead of schedule.*

Kaiser Aluminum Cable is being shipped in ever increasing quantities... to electric power projects serving homes, industry and farms throughout the nation.

Fully integrated operations — which control production from bauxite processing to finished cable — assures you of dependable deliveries of Kaiser Aluminum Cable.

Do you need aluminum conductor? To take advantage of early delivery schedules, contact any office of Permanente Products' nationwide sales organization.

Permanente Metals

PRODUCER OF

Kaiser Aluminum Cable

SOLD BY PERMANENTE PRODUCTS COMPANY, KAISER BUILDING, OAKLAND 12, CALIFORNIA . . . WITH OFFICES IN:
Atlanta • Boston • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Houston • Indianapolis • Kansas City • Los Angeles
Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Portland, Ore. • Seattle • Spokane • St. Louis • Wichita
EXPORT OFFICE, KAISER BUILDING, OAKLAND, CALIFORNIA
Also available through General Electric Supply Corporation, Westinghouse Electric Supply Company, and Line Material Company

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

"'CSP' saved us $17,465.50 in our urban radial system"

So said this midwestern operator after installing 650 Completely Self-Protecting distribution transformers.

When the 2,400-volt radial feeders for urban and suburban areas outside the downtown network system became seriously overloaded, distribution voltages were stepped up to 7,960/13,800 volts wye.

Economically, the utility found this comparison of costs *beyond the price of the basic transformer:*

FOR CONVENTIONAL INSTALLATION		FOR "CSP"* INSTALLATION	
Arrester, installed	$30.00	Additional cost of "CSP" over the conventional transformer—includes built-in lightning and thermal protection plus load indicating light.	$34.13
Fuse mounting and fuse, installed	20.00		
Two 8 ft. crossarms, installed	12.00	Higher pole for secondary lead clearances	5.00
3 ft. crossarm, installed	4.00		
Total	$66.00	Total	$39.13

Simple arithmetic makes 650 "CSP" installations save $17,465.50. What's more, *real* protection from overload was secured—with semiautomatic load check as a bonus. Conventional transformers with fuse links could not supply this protection and still withstand lightning surges.

One thing you can be sure of: the built-in protection of "CSP" saves installation costs. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-70526-A

**Trademark—Reg. U. S. Pat. Off.*

HERE'S PROOF FROM U. S. A.—Thirty case histories of Completely Self-Protecting transformers, with names, dates, places, facts and figures. Get your copy of B-4248.

Call the Westinghouse Salesman

WESTINGHOUSE

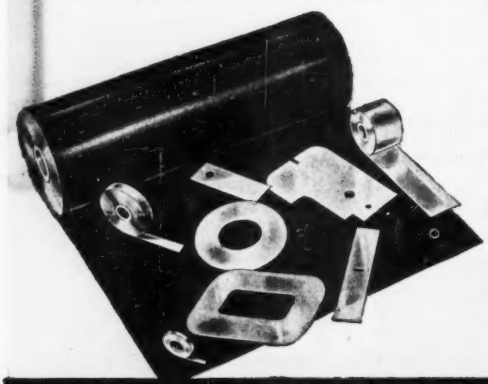
Westinghouse "CSP" TRANSFORMERS

SINGLE PHASE THREE PHASE BANKED SECONDARY

IRVINGTON lowers costs

with

NEW VARNISHED FIBERGLAS* Style OW Insulation



Here's a *new* Irvington insulating material that's important to investigate now. Important because it makes possible the use of Fiberglas (Class B Insulation) at a cost substantially lower than formerly. Important because it provides in a standard product the combination of higher dielectric strength, greater flexibility and high mechanical strength desired in many specific applications.

In making Varnished Fiberglas Style OW, Irvington employs base cloth woven by a new principle that permits the woven fiberglas to carry more insulating varnish. Not only test results, but actual applications have proved its advantages in such services as core wrappings, field coils and punchings. It is available in black or yellow, in thicknesses of .007", .010", .012"; in rolls 25 and 50 yards long; approximately 36" wide; tape in widths from ½" up. Write today for test reports, further details, and samples.

*T.M. Reg. U.S. Pat. Off. by Owens-Corning Fiberglas Corp.

IRVINGTON *Varnish & Insulator Company*

Irvington 11, New Jersey

Authorized distributors in Atlanta; Baltimore; Berkeley; Bluefield, W. Va.; Boston; Charlotte; Chicago; Cleveland; Dallas; Denver; Detroit; Los Angeles; Milwaukee; Minneapolis; New Hartford, N.Y.; New Orleans; Philadelphia; Pittsburgh; Portland, Ore.; St. Louis; Seattle; Hamilton, Ont., Canada.

POWERS line construction and maintenance bodies

This is one of many POWERS Bodies designed specifically for line construction and maintenance work. Readily accessible storage space is provided for tools, fittings, parts, ladders, derrick, rope, wire — in fact everything that's needed for line work. Various models, available for all standard truck chassis, are built to specifications which may be modified to fit your individual requirements.

POWERS Bodies are also available for construction, maintenance, and service operations in all phases of the public utility industry. Write for complete information.

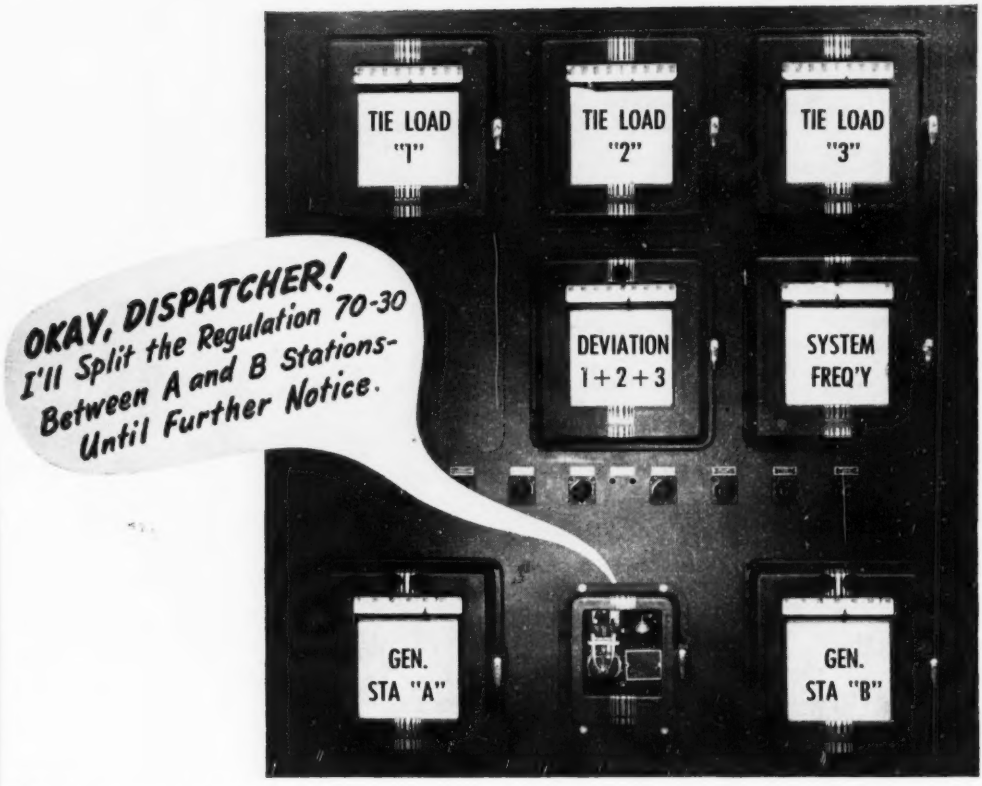
SERIES 25 & 35—General Service Body. Equipped with shelves, bins, and material hooks. Models for ½, ¾ and 1 ton chassis.

AERIAL LADDER — Rotates 360° at various angles of elevation. In several lengths for mounting on light or heavy duty units.

SERIES 300 — Platform Body. Ideal for pole erection and other heavy duty operations in connection with line construction.

ALL-STEEL POWERS Public Utility Bodies

UTILITY BODY DIVISION
McCABE-POWERS AUTO BODY CO.
5900 N. BROADWAY • ST. LOUIS 15, MO.



THE practice of dividing load-regulation between several generating stations is actually over five years old, on some systems and in our experience with the instruments. For it was in 1944, in a southern load-dispatcher's office, that the above panel was put to work. The office faced the problem of preventing unwarranted deviations from the scheduled net interchange across three tie lines, and the panel of instruments was installed to help prevent such deviations, while dividing the required load regulation between two generating stations.

In addition to the L&N Load-Frequency Controller, which is doing the "talking" in the above illustration, the panel has the following instruments: At top, three Tie Line Load Recorders which show actual power flow on the lines; a Recorder for net deviation from schedule on the three ties; a system Frequency Recorder and two Recorders, for generation at the two stations.

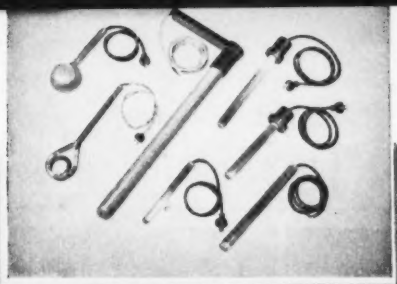
Operation can be summarized as follows: Suppose that the approximate generation on the two regulating stations is nominally 100,000 Kw, exclusive of the regulating burden which is plus or minus that figure. Suppose also that efficiency dictates about 70,000 for one station and 30,000 for the other. The great value of the panel then is this: By merely setting dials in the instruments, the system operator can assign the nominal load 70-30, while assigning the plus or minus regulating burden 2 to 1, or in any other ratio he sees fit. He can thus maintain the scheduled interchange while dividing the regulation between stations in any desired ratio, and while maneuvering about pre-selected station loads.

A similar control set-up, with appropriate additional instruments, could of course handle any number of regulating stations. For a general description of the instrumentation, and of other types of regulation it can provide, ask for our Technical Publication N-56-161(1). Address Leeds & Northrup Company, 4938 Stenton Avenue, Philadelphia 44, Pa.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad ND4-56-461(1)

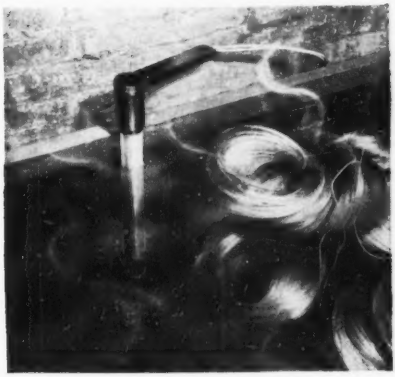


Amersil heaters are available in a variety of shapes and sizes for industrial and laboratory use.

NEW

SUPERIOR IMMERSION HEATER for corrosive chemicals employs fused quartz and NICHROME* V

Amersil heater—fused quartz shell, and element wound with high heat and corrosion-resistant Nichrome V.



Amersil corrosion-proof immersion heater, heating acid solution in a pickling tank.

Here is a new and superior unit for heating corrosive chemicals, manufactured by Amersil Company, Inc., Hillside, N. J.

A Nichrome V wire wound heating element is inserted into a shell of opaque fused quartz, which, in turn, is fitted with an acid-proof head or flange for operation in open or pressure sealed tanks.

The fused quartz shell is completely inert to corrosive chemicals, has a high rate of heat transfer, is a good electrical insulator, and is immune to thermal shock.

Since quartz filters out a very small percentage of infra-red heat waves, and the heat source is immersed, almost 100% efficiency is obtained. Moreover, the unusually compact design of the installation offers the added advantage of cutting heater obstruction within the tank to a negligible minimum—permitting freer flow of liquids.

Once the unit is assembled, it is good for a lifetime—because the shell is quartz and the heating element is ***high heat and corrosion-resistant*** Nichrome V.

This combination of features, makes the Amersil heater superior for service in chemical plant operations involving innumerable corrosive chemical heating problems.

If you have a product whose successful operation depends upon application of an alloy resistant to electrical heat and corrosion, send your specifications to us. In addition to world-famous Nichrome, there are more than 80 other Driver-Harris alloys specifically designed to fill the varied requirements of the electrical and electronic industries.

*Nichrome is manufactured only by

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco, Seattle

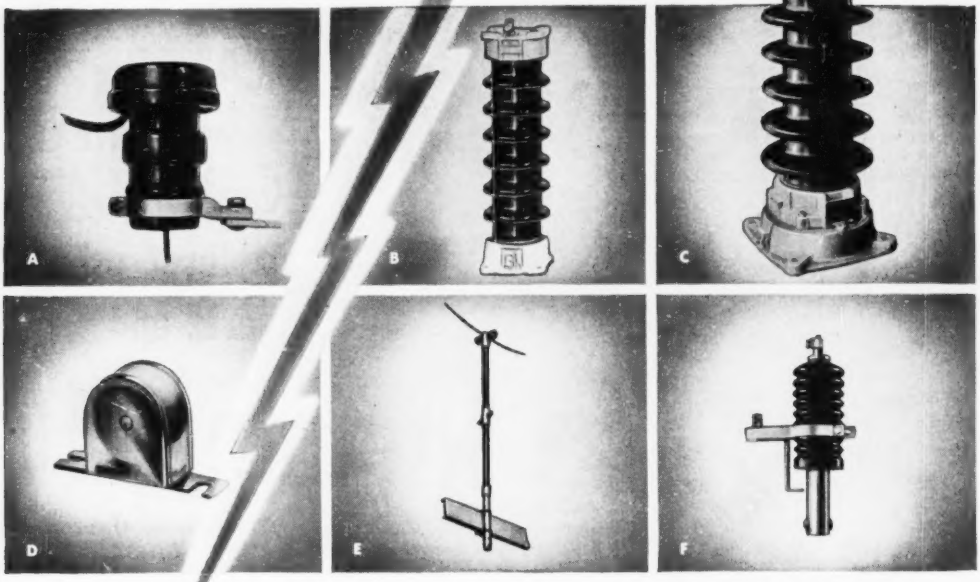
Manufactured and sold in Canada by
The B. GREENING WIRE COMPANY, LTD., Hamilton, Ontario, Canada

50TH YEAR
SPECIAL PURPOSE ALLOYS SINCE 1874
D/H
1899 - 1949

*T.M. Reg. U. S. Pat. Off.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Lightning will strike *110 TIMES* while you read this!

That's just twice the annual average of lightning strokes per minute in the United States—55! And, on that basis, having the right type of lightning protection is certainly important.

Shown here are examples from the complete line of Westinghouse Lightning Arresters. They range from thumb-size signal arresters for safeguarding vital railway operation, to mammoth size, Type SV Station Arresters for protecting the largest electrical systems in the world. The same ingenuity and sound engineering goes into the design of *each* of these arresters, assuring protection of equipment and service under all conditions.

Get the benefits of leadership in lightning protection. Call your nearby Westinghouse Office or Distributor. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60706

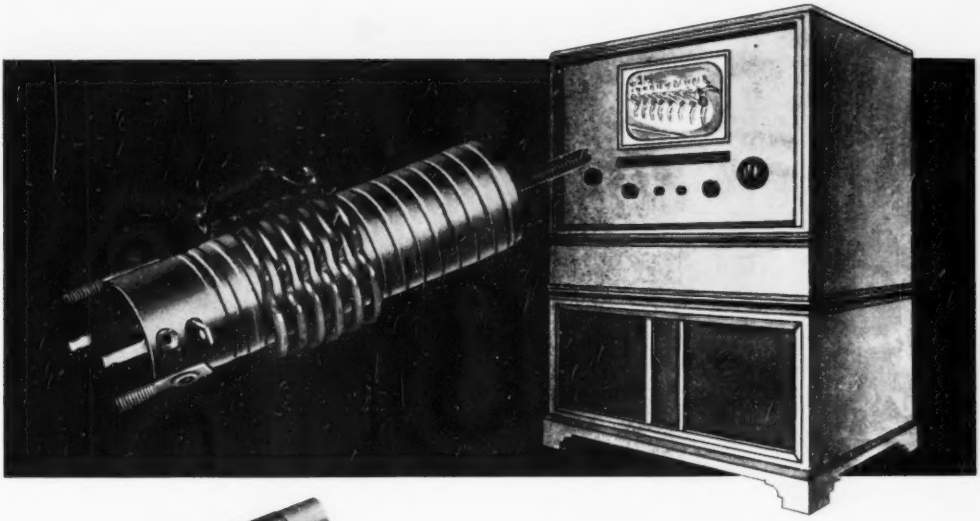
A. **Type LV Autovalve**—for protection of distribution apparatus at voltages from 3 to 15 kv.
B. **Type LVS**—for protection at an economical cost for substations at voltages from 20 to 73 kv.
C. **Type SV**—for protecting continuity of service and large investments in large substations and generating plants at voltages from 3 to 500 kv.
D. **RVS Signal Arresters**—for protection of railway signal circuits.
E. **Type L "De-ion" Tube**—for protection of transmission lines at voltages from 13.8 to 138 kv.
F. **Type A "De-ion"**—for protection of distribution apparatus at voltages from 3 to 15 kv.

Westinghouse

LIGHTNING ARRESTERS

another C-D development . . .

a strong, lightweight, LOW-COST tubing for your electrical applications



Spiral Tubing—one of the many developments that have helped bring television into the mass market. Recently introduced by Continental-Diamond laboratories, it is ideal for electrical, radio, and television applications where a good dielectric tubing with high strength and lightweight is needed. It is available in a variety of sizes and grades to meet requirements for low moisture absorption, forming, riveting, drilling, tapping, etc.

It is another example of why it pays to see C-D first in your search for the right plastic. C-D Plastics provide *practical* combinations of mechanical, electrical, and chemical properties—structural strength, lightweight, moisture, heat and corrosion resistance. For fast delivery, or help with material selection problems, call your nearest C-D office, any time.

DE-5-49

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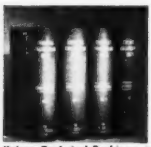

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View of Public Service Electric and Gas Company's new 1500 psig., 1050 F. power station at Sewaren, N. J.

These "firsts" mean piping that lives longer

IN ADDITION to laboratory tests and actual performance figures, there are still other ways to predict the probable life of power piping. One is to look at the record of the company that fabricates the piping—to see what unusual challenges it has met and solved.

Here are three recent fabricating problems overcome by Kellogg, all connected with the high temperature piping at Public Service Electric and Gas Company's new Sewaren Generating Station in New Jersey.

Kellogg was the first to fabricate power piping to operate at 1050 F. It was not a simple job. Nothing could be allowed to go wrong in piping as important as this.

As part of this job Kellogg also fabricated the first 18-8 alloy steel (power) piping for high temperature service. It was designed to connect the throttle valves and steam chests of three turbines operating at 1500 psig. There just couldn't be any defects, any locked-up stresses, any faulty metal formations, or deviations from contour.

In addition, Kellogg created for this same plant a special bi-metallic transition piece through the use of an exclusive electric ingot casting process. It was the first of its kind and was cleverly devised to make a junction, between Croloy boiler leads and Stainless Steel (Type 347 and 316) throttle valves, that eliminated the possibility of failure from expansion stress. This piece precluded the necessity for a tricky welding job that might fail because of a 50% difference in thermal expansion between the two alloys.

These are just some recent Kellogg "firsts" to keep in mind when you place orders for power piping today. You know that each piece of piping delivered, bearing the Kellogg stamp, has not only thirty years of experience behind it, but also the creative thought that met and bested these unusual challenges. You can be sure that know-how like this means power piping that lives longer.

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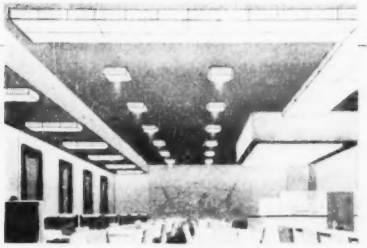

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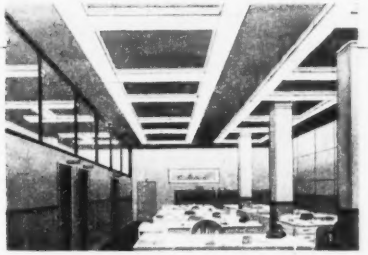

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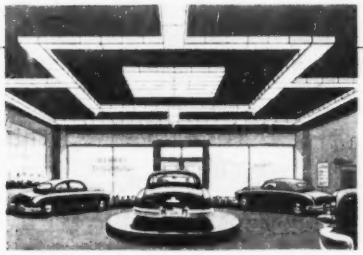

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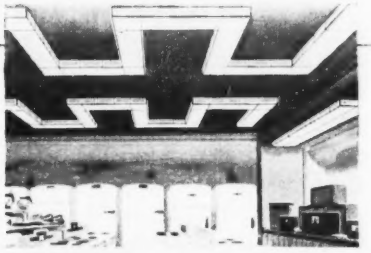

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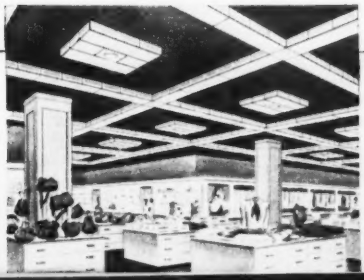

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You have to split the outer covering and trim it off. Then rip off the filler if it doesn't come away clean. Spread the wires apart and u-n-w-i-n-d the kraft paper wrap from one, *then* u-n-w-i-n-d the paper wrap from the other.

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Just split the "Glazon" covering—tear it off—zip! The wires are ready to strip! That's all!

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Not just the 2/64th rubber thickness found in ordinary cable . . . nor even a generous 3/64ths . . . but 4/64ths inch thickness of Type R rubber surrounds each conductor—even on sizes 14 and 12! You can see for yourself what this means in terms of *extra* protection . . . *extra* safety—and at no extra cost!

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Compare the *ordinary* way of preparing *present* types of non-metallic sheathed cable with the *faster* way, the *easier* way, the *simpler* way, of preparing Triangle's *new* TRIEX! See for yourself how you can save time and money at every switch box, outlet box, junction box . . . wherever connections are made!

Available in sizes 14/2, 14/3, 12/2 and 12/3 . . . solid or stranded . . . with or without ground wire. For 600 volt service.

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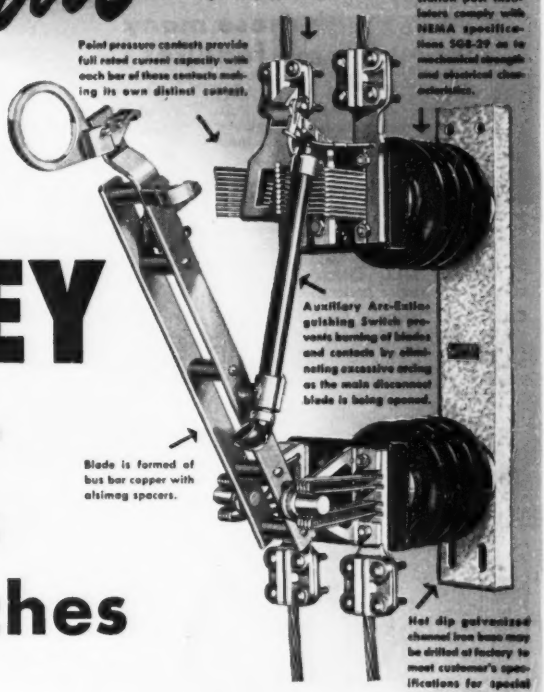
Safe Switching Sequence is Automatic with KEARNEY Regulator By-Pass Switches


Terminals are constructed of high conductivity copper alloy featuring a clamp type design.
3-inch bolt circle station post insulators comply with NEMA specifications SG8-29 as to mechanical strength and electrical characteristics.
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142

Better Construction — *SAFER* Maintenance

FLEET SUPERINTENDENTS—

BUY DODGE -save money

SAVE . . . with these many money-saving features

ENGINES . . . of famous Dodge L-head design save gas, oil, service expense. Full-pressure lubrication, full-length cylinder cooling, and replaceable prefitted main bearings reduce upkeep, prolong life.

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You save money when you buy Dodge *"Job-Rated"* trucks!

There are two reasons for this:

1. Your truck has more money-saving features than any other make of truck built. Many of these are *exclusive* Dodge features.
2. Your *"Job-Rated"* truck is built to fit its job. And trucks that fit the job save on operating costs. They last longer!

Read (at left) a partial list of Dodge truck features that are important to you. Then—see your Dodge dealer for *all* the reasons why a Dodge *"Job-Rated"* truck (priced with the lowest) is the best truck investment you can make.

Priced with the lowest-

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Switch to DODGE "Job-Rated" TRUCKS

Stronger than the steel pin

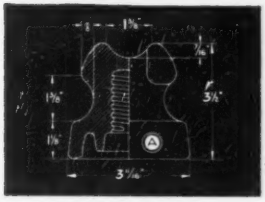
Laboratory and field tests prove that abnormal loads will bend standard metal pins before Armstrong's Glass Insulators will break or crush. This mechanical strength results in part from correct design, the proper placement of pinholes with respect to grooves, and the relative thickness of wall and head sections. It is also a result of the tougher, more weather-resistant industrial glass developed by Armstrong.

Mass produced on completely automatic machinery, Armstrong's Insulators cut as much as 40% off the cost of insulating low and medium voltage distribution lines. They do this with complete safety. Every Armstrong's Insulator meets or exceeds its respective E.E.I., A.S.T.M., and A.S.A. specification. Every pin cavity is hand gauged for diameter and thread contour. And each production run is tested for resistance to thermal shocks far more severe than any likely to be encountered in service.

Call your distributor for samples and prices today. Or write Armstrong Cork Co., Industrial Div., Millville, N. J. Armstrong's Insulators are available for export.

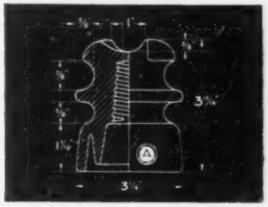
Catalogue No. 51-C1
Made in Brown and Clear Glass

Edison Electric Institute Class	1
*Dry Flash-over—Volts	43,300
*Wet Flash-over—Volts	23,500
Average Mechanical Strength, Lbs.	3,400



Catalogue No. 51-1A
Made in Brown and Clear Glass

Edison Electric Institute Class	1A
*Dry Flash-over—Volts	59,000
*Wet Flash-over—Volts	26,000
Average Mechanical Strength, Lbs.	2,500



Catalogue No. 51-2U
Made in Brown and Clear Glass

Edison Electric Institute Class	2
*Dry 60 Cycle Flash-over—Volts	59,000
*Wet 60 Cycle Flash-over—Volts	23,000
Approx. Mechanical Strength, Lbs.	2,500

*Test by Electrical Testing Lab., New York

ARMSTRONG'S GLASS INSULATORS
do the job for 40% less

Take this step toward new economy in connector buying. Try Locke *Split Bolt* Connectors. In addition to 12 big construction features, laboratory tests reveal that on most applications Locke Connectors give you up to 50% *greater reusability!* The reason? *An exceptionally high yield point of 54,000 pounds per square inch.*

The new Locke TECH-REPORT on Split Bolt Connectors gives you the complete engineering story. Write for it today.

ECONOMIZE! **Standardize on Locke Split Bolt Connectors. Styles and Sizes for every type of electrical connection**

Send today for new Locke TECH-REPORT on Split Bolt Connectors.

Everything you want in a Connector plus *greater reusability*

Isn't this just about everything you've ever wanted in a connector? Add greater reusability to the 12 features below, and you'll see why this is *the* connector for quality-minded buyers who are looking for new ways to economize!

1. High strength Copper Alloy.
2. High conductivity.
3. No season cracking.
4. No twisting or distortion when tightened.
5. No sharp edges, machined finish.
6. Snug fitting pad with round bearing surface.
7. Strong, free-running nut.
8. Ample end bevel means easy assembly.
9. Easy identification, clear markings.
10. Extra wide wrench grip on body.
11. Corrosion resistance.
12. Extra length pressure bar prevents thread stripping.

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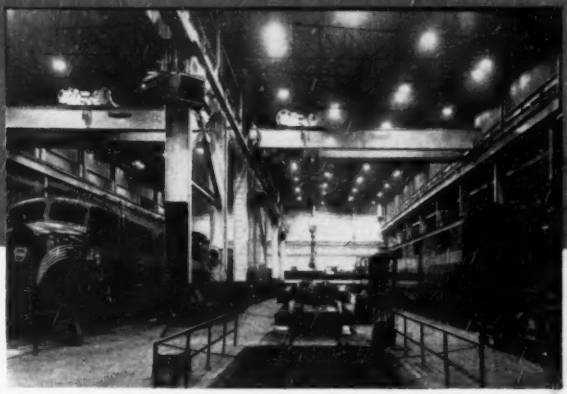
INCORPORATED
BALTIMORE, MARYLAND

before you buy... **STOP!** *...see what* LOCKE'S *got!*

MAIN LINE SCHEDULES
Maintained with
APPLETON LIGHTING

INDUSTRIALITE
HIGH MOUNTING FIXTURE

For use in railroad yards, and roundhouses, steel mills, foundries—hundreds of industrial installations.



Here's the Appleton Industrialite High Mounting Fixture in use in the Harrisburg, Pa., Diesel-Electric Locomotive Shop of The Pennsylvania Railroad, world-famous leader in American transportation. In transportation service centers, as in countless more industrial fields, Appleton Lighting Equipment provides the basis of profitable production.

A typical example of Appleton specialized design, the Industrialite High Mounting Fixture is ruggedly constructed to deliver top performance under the most severe conditions. This fixture carries a special flange on its cast aluminum hood that eliminates the possibility of the reflector jarring loose and falling to the ground. The unit is furnished with a heat and impact resisting glass lens in a vapor and dust-tight cover assembly.

The complete Appleton line of lighting equipment includes a type and size fixture for virtually every industrial requirement—indoors or out. Each Appleton Fixture is designed to permit easy installation, easy wiring, convenient servicing.

For the finest industrial lighting equipment, specify Appleton—STANDARD FOR BETTER LIGHTING.

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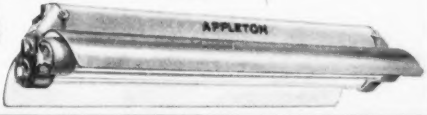
FOR HAZARDOUS LOCATIONS

Appleton offers numerous types and combinations of dependable explosion-proof fixtures. Also Dust-Tight and Vapor-Tight fixtures in the exact type and size for your requirements.



TWIN HIGHLITE
HIGH MOUNTING FIXTURES

Designed to produce high levels of illumination from a minimum number of outlets in high bay industrial interiors.

APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

To simplify your motor repairs

USE THIS NEW GENERAL-PURPOSE* INSULATING VARNISH...

Here at last is a top-quality insulating varnish that you can use with real assurance in repairing ALL TYPES OF MOTORS (except extra high-speed armatures). It's General Electric's new 9574, developed after long research and careful testing under all kinds of operating conditions. These are some of the advantages that this material offers you:

G.E.'s 9574

Easier to use. G-E 9574 is a phenolic drying-oil varnish. It's remarkably easy to handle, yet it gives maximum protection as a general-purpose insulation. High flash point (100 F). And its viscosity of 250 C. P. average (at 45 F) makes it usable at barrel gravity. No special thinners required—use petroleum spirits.

Cures at low temperatures. This clear-baking varnish cures at low temperatures. A baking cycle as low as 212 F is satisfactory with conventional equipment. Also cures by infra-red.

Try 9574 on your motors—Simplify your repair work; note the exceptional resistance qualities it offers you to provide LONGER LIFE for the motors you repair. For more details, write for new bulletin to your local G-E Distributor or Section 25-9, Chemical Department, General Electric Company, Pittsfield, Massachusetts.

**G-E 9574 gives excellent results on all types of coils except extra high-speed armatures.*

You Can Put Your Confidence in

GENERAL ELECTRIC

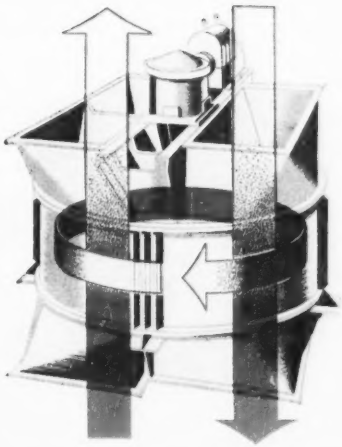
Fact File on Preheat

IN THE LJUNGSTROM, heat is not required to pass *through* the metal and its surface accumulations.

This type of air preheater maintains heat recovery at a *constant level* despite the inevitable surface accumulation of soot and fly ash.

Between cleanings, the surface "as is," acts as an efficient heat storage and transfer medium.

LJUNGSTROM



The Ljungstrom Air Preheater is a compact gas-to-air or gas-to-gas heat exchanger, operating on a continuous regenerative counterflow basis. Hundreds of power plants and other special applications confirm its high level of heat recovery and long-term service at low maintenance expense. Write for engineering details to:

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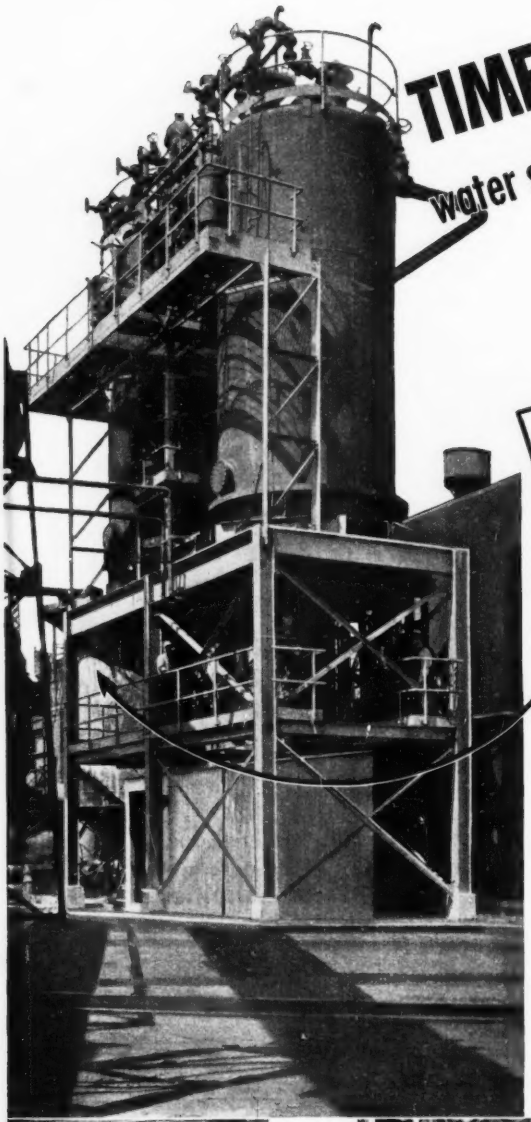
Plant: Wellsville, N. Y. 381

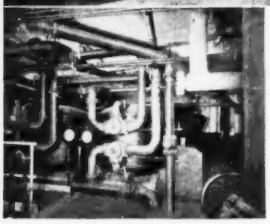
TIME (and improvement in water softening) MARCHES ON!



Original (1925) Softener

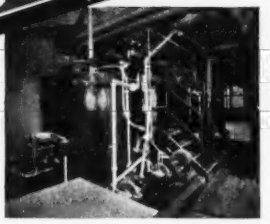
IN 1925, a Cochrane Hot Process Softener was installed in the Tilghman Street Gas Plant of the Philadelphia Electric Company at Chester, Pa. Now, 24 years later, this faithful old piece of equipment has been replaced by a new Cochrane Double Unit Hot Process Softener of 20,000 GPH capacity (10,000 GPH per unit). The double unit permits great flexibility of operation as one or both units may be used as desired. The needs of the plant have outgrown the capacity of the first unit which is largely the reason for the change, but the improvements in the process and the apparatus since 1925 are interesting in comparison with the old veteran. Welded construction replaces riveted, chemical proportioning and feeding are improved, automatic controls are featured and softening is accomplished with a speed and accuracy of result undreamed of in 1925.

COCHRANE
SINCE 1863



(Left) Two vertical pressure filters replacing existing conical filters shown in background

(Left) phosphate tank with motor driven agitator for mixing supplemental phosphate feed



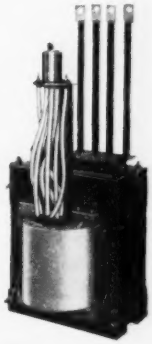
(Left) Lime soda proportioners and mixing tanks

COCHRANE CORPORATION • 3146 N. 17th Street • PHILADELPHIA 32, PA.

Better... Lighter Weight... Smaller... More Efficient... Less Costly to Store... Easier to Install

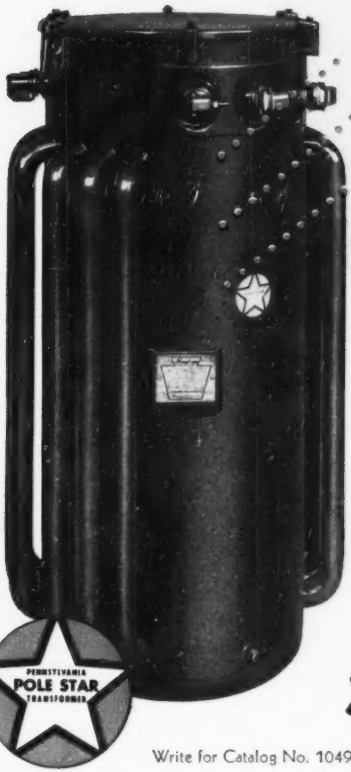
4 NEW PENNSYLVANIA POLE STAR TRANSFORMERS

37½ · 50 · 75 · 100 KVA



Interior assembly of 75 Kva POLE STAR. Core can be taken apart and rebuilt without changing the core loss or exciting current.

The new 100 KVA POLE STAR TRANSFORMER



is **35%** *lighter*

requires **36½%** *less oil*

covers **35½%** *less floor area*

than the 100 KVA Stacked Core Transformer it replaces

Now a COMPLETE LINE OF POLE STARS from 3 KVA through 100 KVA

The four transformers now added to the POLE STAR line are fundamentally the same as the original POLE STARS. Cores are wound of cold rolled steel. Core laminations are individually lapped for low exciting current and ease of disassembling and rebuilding the core and coil unit. On 2400 and 4800 volt units straight, side-issuing, high voltage bushings, with insulating caps, replace pockets and pocket bushings. Transformers are of Sealed Tank construction. Synthetic rubber gaskets are used throughout.

In other words: The POLE STAR is a better transformer than the stacked core transformer it replaces. It operates with greater efficiency and at less cost. It is lighter in weight, smaller in dimensions, cheaper to store and easier to install.

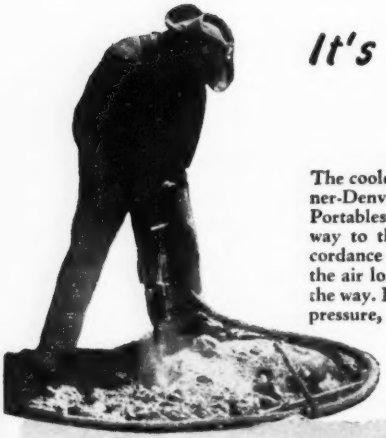
PENNSYLVANIA POLE STAR TRANSFORMER

Write for Catalog No. 1049

***Pennsylvania* TRANSFORMER COMPANY**

PITTSBURGH 12, PENNSYLVANIA

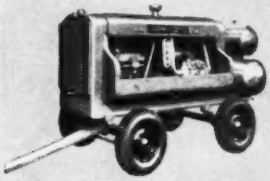
P.S. LET THE POLE STAR BE YOUR GUIDE ... Product Of Long Experience—Safe Thrifty And Reliable



It's the pressure at the tool that counts!

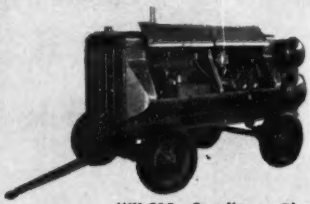
The cooler air discharged from Gardner-Denver Two-Stage, Water-Cooled Portables has less heat to lose on the way to the tool. Therefore — in accordance with basic laws of physics — the air loses less of its pressure along the way. It reaches the tool at a higher pressure, and this vigorous air pressure lets every tool work at full capacity — full speed — full efficiency.

For a vigorous, steady, uninterrupted air supply — regardless of altitude, temperature or weather extremes — choose a Gardner-Denver Portable in the size to fit your needs. *Write today for full information.*

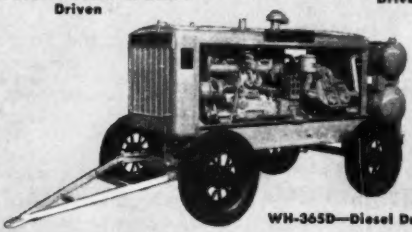


WH-210—Gasoline or Diesel Driven

WH-185—Gasoline or Diesel Driven

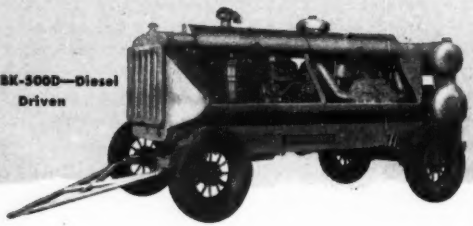


WH-315—Gasoline or Diesel Driven



WH-365D—Diesel Driven

WH-420D—Diesel Driven



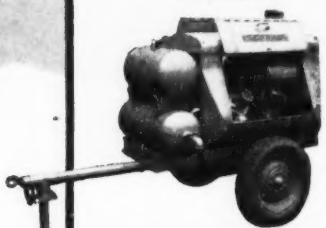
WBK-500D—Diesel Driven

GARDNER-DENVER

Since 1859

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada) Ltd., Toronto, Ontario

NEW **Gardner-Denver Quality in a 60 cubic foot compressor**

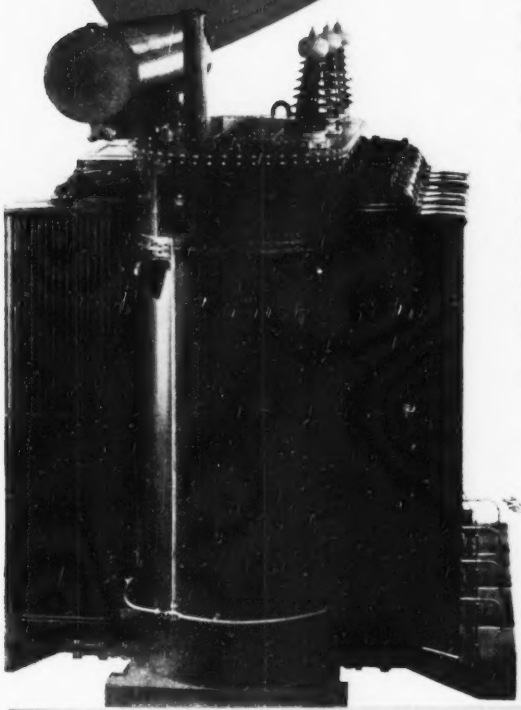


ADO-60—Utility Portable Air Compressor

Standard

TRADE MARK ®

The Seal of Transformer Dependability

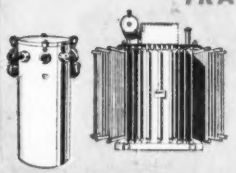


Your transformer needs are specifically met by STANDARD, because our facilities are exclusively devoted to transformer design and manufacture. Difficult assignments have been our meat. We design and build to your specific needs, and all designs meet NEMA and EEI standards. Use STANDARD'S quarter of a century of experience to make your installations adequate, safe and dependable.

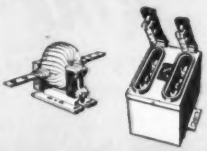
Pictured here is a 10,000 KVA three phase power transformer designed for a specific application. Forced air cooling for 25% load increase is supplied. Used for step-up from 13,200 to 69,000 volts. Discuss YOUR transformer requirements, whether large or small, with the nearby Standard Transformer Company representative.

THE STANDARD TRANSFORMER COMPANY
WARREN, OHIO
Representatives in Principal Cities

TRANSFORMERS FOR EVERY APPLICATION

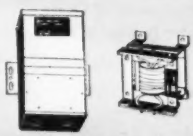


Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)



Instrument transformers (for use on circuits up to 72,000 volts, inc.)

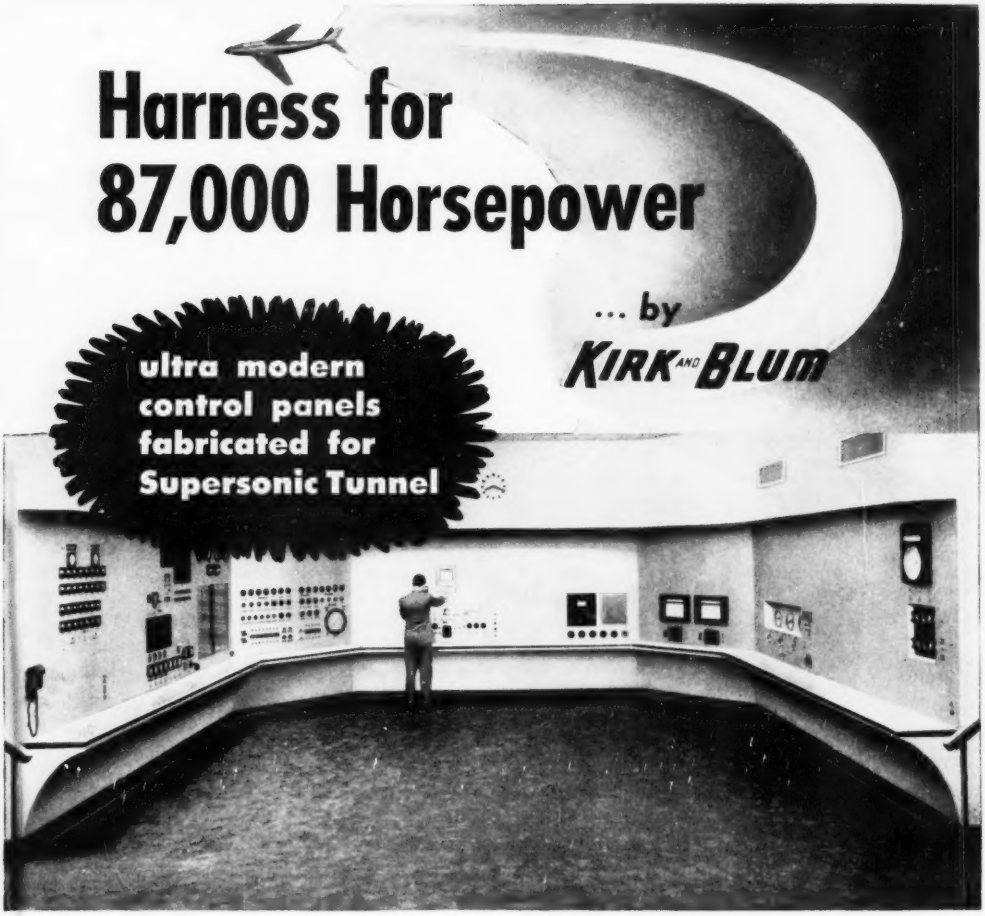
Dry type (up to 1000 KVA and max. voltage ratings of 4800)



Control transformers (compound filled or open type)

Harness for 87,000 Horsepower

... by KIRK AND BLUM



To simulate flight conditions up to 1500 miles per hour at altitudes near 35,000 feet is the job of this newest wind tunnel of the National Advisory Committee for Aeronautics, Lewis Flight Propulsion Laboratory at Cleveland, Ohio. Control for the giant 87,000 HP motor and its two-million cubic feet of air per minute compressor are centered on a control board fabricated by KIRK & BLUM.

The control panels are made of $\frac{1}{4}$ inch steel. The desks below are of 16 gauge steel with Formica tops. An inlaid rubber foot rest is provided below the desks.

This is another example of the many types of electrical enclosures built by KIRK & BLUM for Industry, Power Plant, Utilities and other users.

Large or small units . . . one or a thousand . . . that's the range of KIRK & BLUM facilities, backed by over 40 years of experience.

Write for Booklet "Sheet Metal Assemblies," showing the complete list of equipment and facilities KIRK & BLUM has available to produce your product.

KIRK AND BLUM

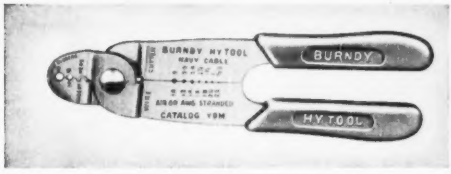
The KIRK & BLUM MANUFACTURING CO.
2906 Spring Grove Ave., Cincinnati 25, Ohio

• Control Desks and Panels • Switch Gear Housings • Instrument Panels • Cubicles • Transformer Housings and Tanks • Electrical Enclosures • Machine Bases • Ventilating Louvres

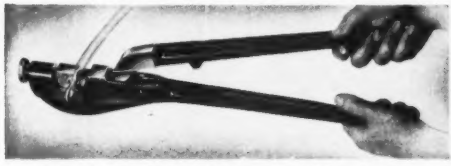
Tools that replace the Torch...

Burndy Hydraulic Hypress—Y34-A. Hand-operated—weight 9 lbs.; 18,000 lbs. pressure; for conductors No. 6 through 500 Mcm. Used to install Hylugs, Hylinks, Hytaps and overhead Hysplices.

BURNDY Hytools and Hypresses



Burndy All-Purpose Hytool—Y9M. Hand plier with wire cutter and stripper. For conductors No. 22 through No. 10.



Burndy Hytool MY29. Hand-operated—for conductors No. 8 through 4/0 without change of dies.

Burndy Hydraulic Hypress—Y34-B. Foot-operated type; 18,000 lbs. pressure; for conductors No. 6 through 500 Mcm.

WHY fuss with solder when making electrical connections? Efficient, rapidly operated Burndy HYTOOLS and HYPRESSES indent one-piece, pure copper HYDENT connectors onto all conductors from #22 through 2000 Mcm.

With this modern HYDENT connecting method you assure uniform depth of indent, and *strong, efficient electrical connections, every time.* But more, you make substantial savings on *every* connection. You just insert the conductor into the connector barrel, and indent with the HYTOOL. *Nothing simpler . . . nothing quicker . . . nothing surer!*

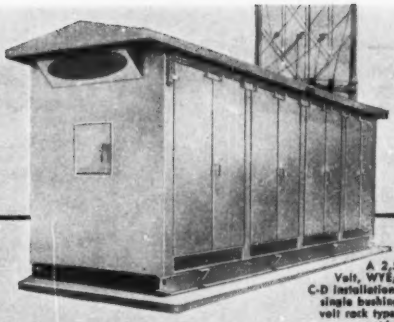
No matter what your requirement, Burndy has the right tool for your connecting needs . . . hand, portable or bench types; manual, hydraulic or pneumatic operation. Get all the facts. Send for Burndy HYDENT Catalog Y46 today.

Hylugs—Hylinks—Hysplices are a few of the many Hydent connectors.

Connect with
BURNDY

New York 54, N. Y.
WESTERN BRANCH: Vernon 11, California
CANADA: Canadian Line Materials, Ltd., Toronto 13

SPECIALIZATION PAYS DIVIDENDS . . . when utilities install



A 2,520 Kvar; 12,470 Volt, WYE; isolated neutral, C-D installation consisting of 168 single bushing, 15 Kvar, 7,200 volt rack type capacitors, in an outdoor, weather-proof housing, with temperature-controlled, forced ventilation.

CORNELL-DUBILIER CAPACITORS FOR POWER-FACTOR IMPROVEMENT

That C-D specialization pays dividends is proved by the more than a decade of trouble-free field service delivered by C-D capacitors. It's the kind of equipment you can install and forget, proving once again that *the specialist does it best.* Next time specify C-D—the better capacitor. A C-D field engineer will be glad to discuss with you capacitors designed for your specific power-factor improvement needs. Your inquiry is cordially invited. Catalog on request. Cornell-Dubilier Electric Corporation, Dept. D99, South Plainfield, New Jersey. Other plants in New Bedford, Worcester, Brookline, Mass.; Providence, R. I.; Indianapolis, Ind. and Cleveland, Ohio.

Follow the leaders
Demand dependable C-D Capacitors—built by capacitor specialists.

C-D Best by Field Test!

CORNELL-DUBILIER CAPACITORS
1910 1949
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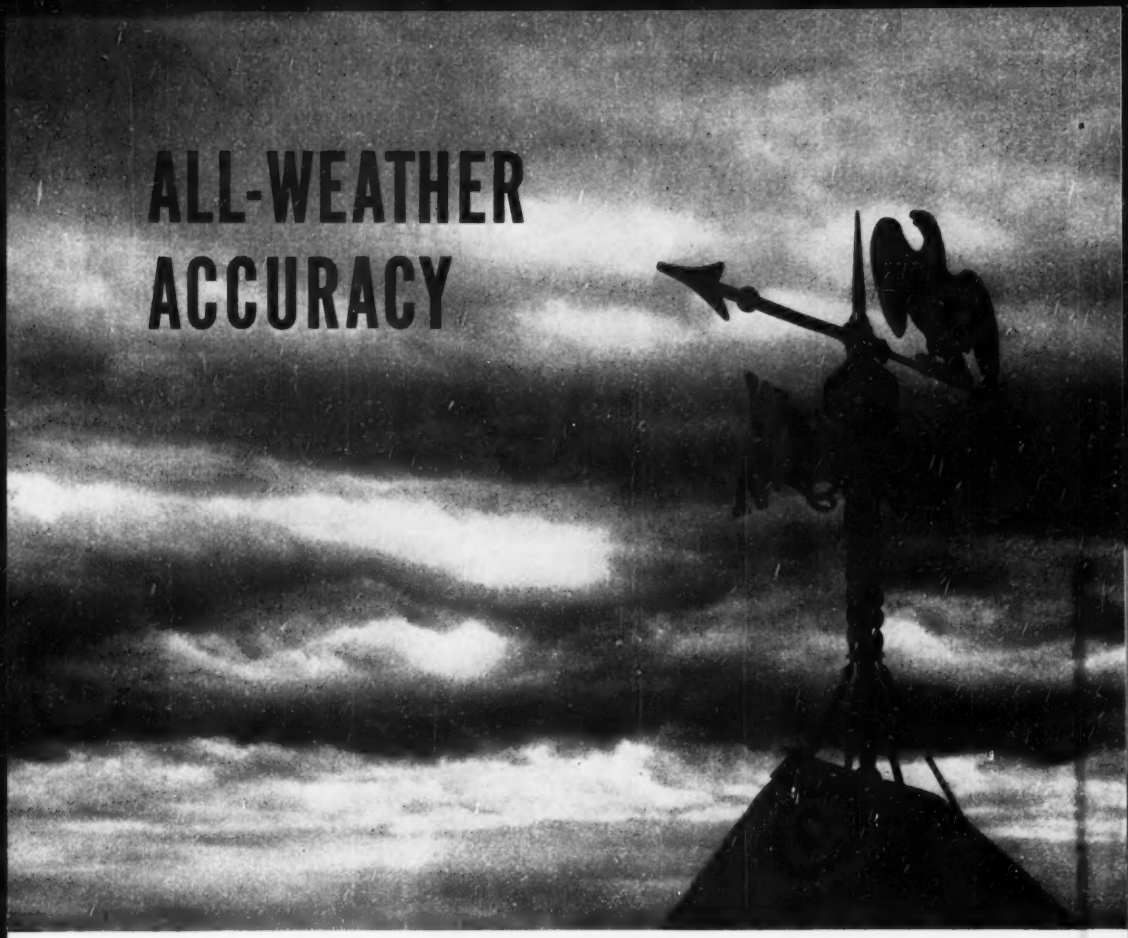
WORLD'S LARGEST MANUFACTURER OF CAPACITORS



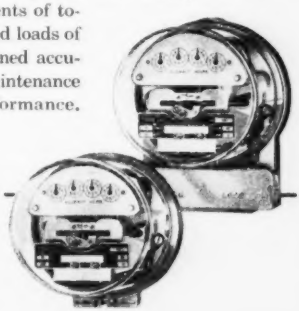
Sangamo J Watthour Meters

Even severe lightning disturbances leave the accuracy of your Sangamo J Meters unimpaired—9 years of field experience with millions of J Meters have proved this fact. Alnico magnets, shielded construction, and surge-resistant insulation are responsible for this "all-weather" accuracy.

The Alnico magnets used in J Meters have great power to resist the demagnetizing effects of lightning. They are clamped between aluminum frames which provide a conducting shield to further assure unusual freedom from loss of damping force by any cause. Sangamo J Meters are fully compensated for temperature extremes and accurately measure all power delivered at sub-zero or torrid temperatures.

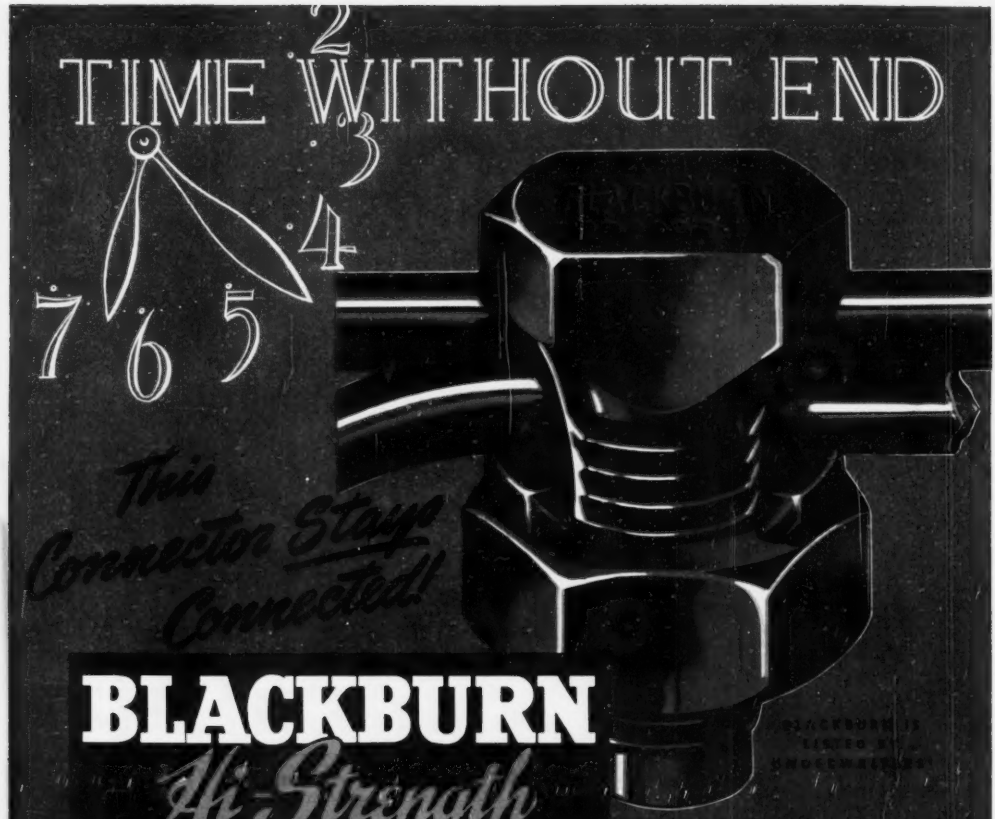
* * *

Sangamo J Meters have proved their ability to meet the requirements of today and the anticipated loads of the future with sustained accuracy, economy of maintenance and troublefree performance.



50TH ANNIVERSARY SANGAMO 1899 - 1949

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS



BLACKBURN *Hi-Strength* CONNECTORS

BLACKBURN Hi-Strength Connectors stay tight and trouble-free on the lines because they are truly *high-strength* connectors. They are made of famous DURONZE, which is 50% stronger than hard copper or bronze commonly used in the industry. Hence they will not twist or distort when installed tightly, and make an efficient, lasting connection.

Tests of BLACKBURN Hi-Strength Connectors show that the conductivity of a tapped joint is actually better than the solid wire itself. And BLACKBURN Connectors may be removed easily for wire changes, and can be used over and over again. In brief, you will get the best you can buy at no extra cost, when you specify BLACKBURN Connectors.

Millions in Use Throughout the World

OVER 100 CONVENIENTLY-LOCATED JOBBERS' STOCKS

Write for New Catalog, featuring the full line of Blackburn Products.

JASPER BLACKBURN PRODUCTS CORP., First, Madison & Clinton Sts. • St. Louis 6, Mo.

Whatever the kind or quantity of steel you want—

MORE than ever before, we are equipped to give your orders for steel unexcelled attention. Our warehouses, coast-to-coast, have the facilities, the equipment and the personnel to satisfy your requirements—whether you need a pound or a ton of steel. Furthermore, our metallurgists are always ready to assist you with any problem of steel selection or application.

So, make it a rule—whenever you need steel—Stainless, High Strength, Alloy . . . Hot Rolled or Cold Finished Bars, Structural Shapes, Plates, Sheets, Aluminum, Metal-Working Tools, Supplies, and Machinery—to "Call Us." Just phone, wire or write the warehouse or sales office nearest you.

UNITED STATES STEEL SUPPLY COMPANY · USS STEELS · SERVICE

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United States Steel Supply Company
Dept. M-99, 208 S. La Salle St., Chicago 4, Ill.

Without obligation on our part, please send us FREE booklets on the U·S·S Steels checked below:

☐ Stainless ☐ Alloy

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Firm Name.....

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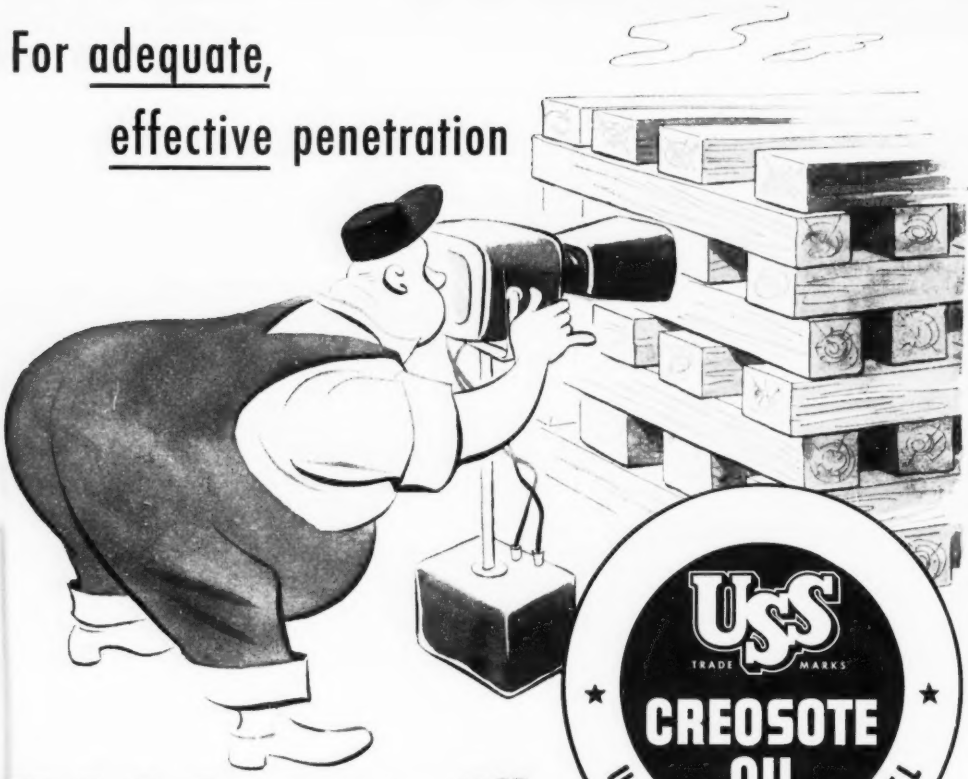
USS

UNITED STATES STEEL

For adequate, effective penetration



U·S·S Creosote Oil

Consistently-high penetrating power is an important reason why U·S·S Creosote Oil has been the first choice of so many wood-preserving men for more than 20 years.

This adequate penetration carries protection against rot, decay and termites deep into the wood. Coupled with the high toxicity of U·S·S Creosote Oil, it adds years of extra life to poles and crossarms.

Continuous processing in the world's largest tar distillation plant makes possible the uniform quality of U·S·S Creosote Oil . . . enables you to obtain the same good results application after application.

Whether you operate your own treating plant or buy treated poles and crossarms, it will pay you to specify U·S·S Creosote Oil . . . there's no better preservative to be had. For more information on the effectiveness of U·S·S Creosote Oil, write us. There's no obligation.

COAL CHEMICAL SALES DIVISION
United States Steel Corporation Subsidiaries
71 Broadway, New York 6, N. Y.

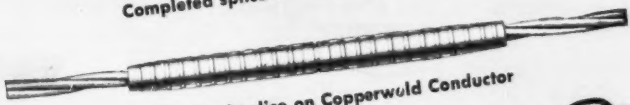
USS **CREOSOTE OIL**

UNITED STATES STEEL

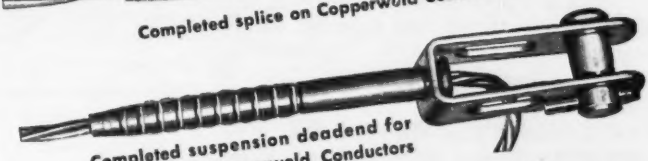
"Job Proven" THE WORLD OVER Nicopress

Illustration of No. 51 type Nicopress tool with P. & J. Grooves.

Completed splice on Solid Copper Conductor



Completed splice on Copperweld Conductor



Completed suspension deadend for Copper and Copperweld Conductors

Partially completed reinforcing sleeve on Copperweld

Nicopress sleeves and tools are available in a complete range of sizes for Copper, Copperweld-Copper, A. C. S. R. and Steel Conductors.

Nicopress

is the Registered Trade Mark of The National Telephone Supply Company

The National Telephone Supply Company

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THE NATIONAL TELEPHONE SUPPLY COMPANY

In Heavy Duty Aircraft Relays,

the Tough Jobs are Handled by . . .

MALLORY Contacts

The complex electrical systems of modern bombers and airliners must never fail. Even when overloaded, relay contacts must not stick or overheat.

These specifications are high, indeed. But one contact material—Mallory D-54*—has come through with flying colors! The tests Mallory D-54 Contacts have to withstand include:

On resistive load—50,000 operations at rated load.

Overload test—Contacts must withstand 100 operations at 8 times rated load.

Motor load—Contacts must withstand 50,000 operations at 6 times rated load.

On relays rated 200 amperes and up, to our knowledge no other contact material has performed as successfully as the Mallory D-54 silver-cadmium oxide.

What's Your Problem?

Mallory D-54 is only one of the many superior Mallory Contact materials available to you. Mallory has successfully produced *so many kinds* of contacts that there is probably a standard Mallory Contact to fit your most demanding design. However, if Mallory does not have such a material available—our engineers are equipped to develop the contacts you need.

In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

For all kinds of contact materials and service, Mallory is your most dependable and experienced source.

Electrical Contacts and Contact Assemblies

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

SERVING INDUSTRY WITH

Capacitors	Rectifiers
Contacts	Switches
Controls	Vibrators

Power Supplies

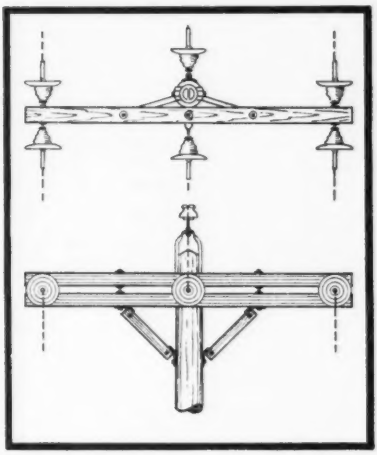
Resistance Welding Materials

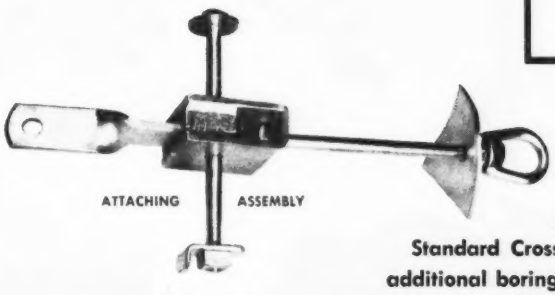
*Reg. U. S. Pat. Off.

HUGHES

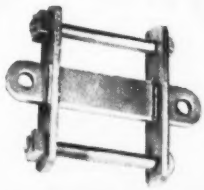
NO. 2890 DOUBLE ARM ASSEMBLY CARRIES DOUBLE LOAD

Plus!





ATTACHING ASSEMBLY



DEAD END ASSEMBLY

Standard Cross Arms taken from stock, with no additional boring, may be assembled with Hughes No. 2890 hardware into a dead end assembly which by actual field test has proven far superior in strength over the conventional method of double arm dead ending. Comparative test data is available upon request.

Hughes No. 2890 assembly, except for cross arms, is furnished as a complete unit with fittings, bolts and washers necessary for installation.

WHEN IT'S HUGHES— IT'S Tailored TO YOUR NEEDS

HUGHES BROTHERS
SEWARD NEBRASKA
FOUNDED - 1921 INCORPORATED

"HUGHES" TRANSMISSION & DISTRIBUTION MATERIAL MFRS. WOOD METAL

Approved ... for use on R.E.A. FINANCED SYSTEMS!

All Illinois Porcelain Insulators listed below, a few of which are illustrated, are on the list of materials acceptable for use on Rural Electrification Administration financed systems.

No. 1261 Suspension Type R.E.A. Approved Insulator.

No. 1937 Reinforced Type R.E.A. Approved Wireholder.

Specify ILLINOIS PORCELAIN INSULATORS

SUSPENSION TYPE

Dead End	No. 1261, 6" dia.
Ball and Socket	No. 1253, 10" dia.
Clevis Type	No. 1271, 10" dia.

DISTRIBUTION TYPE

Pin Type	No. 261
Pin Type	No. 175

SPOOL TYPE

Secondary Rack	No. 101, 1¾" dia. groove
Secondary Rack	No. 96, 3" dia. groove
Service Rack	No. 100, 1⅜" dia. groove. (wet or dry process porcelain)

STRAIN TYPE

No. 502 No. 534 } Use dependent upon strength
No. 536 No. 540 } and cable requirements.

WIREHOLDER TYPE

Reinforced	No. 1937, 2¼" screw
Reinforced	No. 1937-3, 3" screw

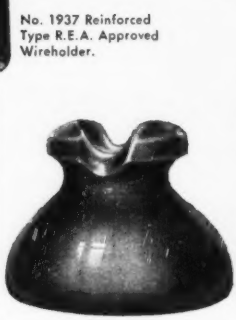
DEAD END CLAMPS

No. 2106 No. 2107
No. 2115 No. 2116

SUSPENSION CLAMPS

No. 2300, for angle mounting

No. 6240-U
No. 6241-U } Use dependent upon
No. 6243-U } type of cable.



No. 261 Pin Type R.E.A. Approved Insulator.

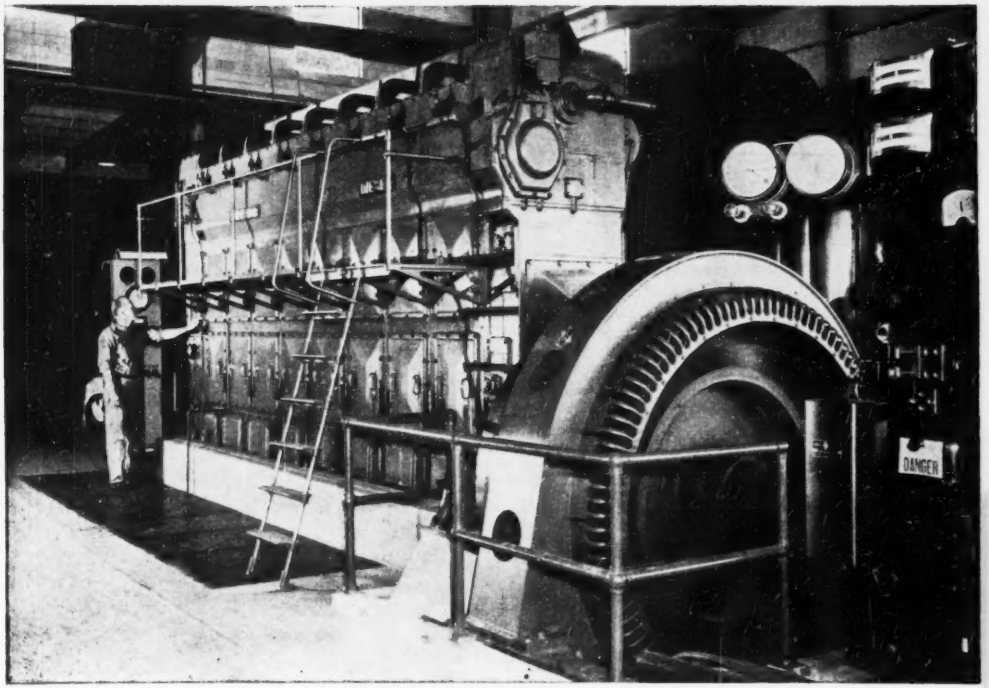
No. 175 Pin Type R.E.A. Approved Insulator.

No. 502 Guy Strain Type R.E.A. Approved Insulator

No. 101 Spool Type R.E.A. Approved Insulator.

WRITE TODAY FOR COMPLETE INFORMATION

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS



THEY'RE TURNING NIGHT INTO DAY

An Iowa town is enjoying brighter nights and dependable electrical power because they installed a Superior Diesel. The engine they chose is a supercharged model 80-GX-8. It will deliver dependable power for many years under continuous heavy duty service.

Superior Supercharging provides greater power output from the same engine. This overall increase in mechanical efficiency means lower fuel costs per kilowatt hour at maximum and partial loads. Operation of Superior Supercharging is fully automatic. No control devices are necessary.

One of our field representatives will be glad to show you how a Superior Supercharged Diesel can solve your power problems. Just write and tell us when he can call.

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL SUPPLY COMPANY NSCO

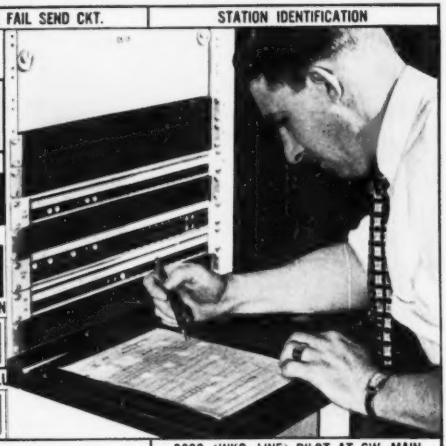
Superior DIESEL

ALARM INDICATOR RECORD

TIME RECEIVED | A P | BY | TROUBLE FOUND | DATE OK | TIME | A P | BY

He can see a thousand miles

	SYNCHRONIZATION - START					CA FAIL SEND CKT.
1	ON	ON	OFF	ON	ON	CHAN. 1 SECT
	SYNCHRONIZATION - STOP					FUEL GAS LOW
2	ON	ON	OFF	ON	ON	
	FUSES		24-VOLTS		ABS	
3	DISCH.	DIST.	H-L VOLT	REG. FAIL	24V 130V	48V
	POWER CONTROL PANEL FAILURE					
4	201-202W	203-204W	205-206W	207-208W	201-202E	203-204E
	ALT. CONT. BAY - NO VOLT. OUT.				NO VOLT. - TRAN	
5	201 202	203 204	205 206	207 208	201 202	203 204
				RECTIFIER - INVERTER FAILU		
6	RECT. FAIL 24/130V	48 V H-L VOLT		NO. 1	NO. 2	NO. 3



	64 KC PILOT ALARM AT NON-SW. MAIN								3096 (WKG. LINE) PILOT AT SW. MAIN			
7	201	202	203	204	205	206	207	208	201 203	205 207	202 204	206 208
	2064 KC PILOT ALARM AT NON-SW. MAIN								3096 (SP. LINE) PILOT AT SW. MAIN			
8	201	202	203	204	205	206	207	208	201 203	205 207	202 204	206 208
	3096 KC PILOT ALARM AT NON-SW. MAIN								SP. LINE FAIL AT SW. MAIN			
9	201	202	203	204	205	206	207	208	201 203	205 207	202 204	206 208
	TOT. LINE FAIL AT SW. MAIN				AUTO. SWITCH AT SW. MAIN				AUTO. SW. LOCKED AT SW. MAIN			
10	201 203	205 207	202 204	206 208	201 203	205 207	202 204	206 208	201 203	205 207	202 204	206 208

11

Carrying hundreds of telephone calls, coaxial cable runs through many lonely miles. Far from towns and people, master amplifying stations stand guard with a new automatic alarm system developed by Bell Telephone Laboratories.

12

At a city terminal, the man on duty makes a check by laying a transparent log sheet over a glass window, and dialing a master station hundreds of miles away. At once the station begins to give an account of itself, lighting lamps under the log sheet to report any abnormal operating condition before it becomes an emergency.

13

But when something happens that threatens serious trouble, the apparatus acts at once – maybe by switching in a spare coaxial – and calls a distant test board by ringing a bell. Sometimes he can take further steps by remote control; if not, he knows exactly how to brief the nearest repair crew.

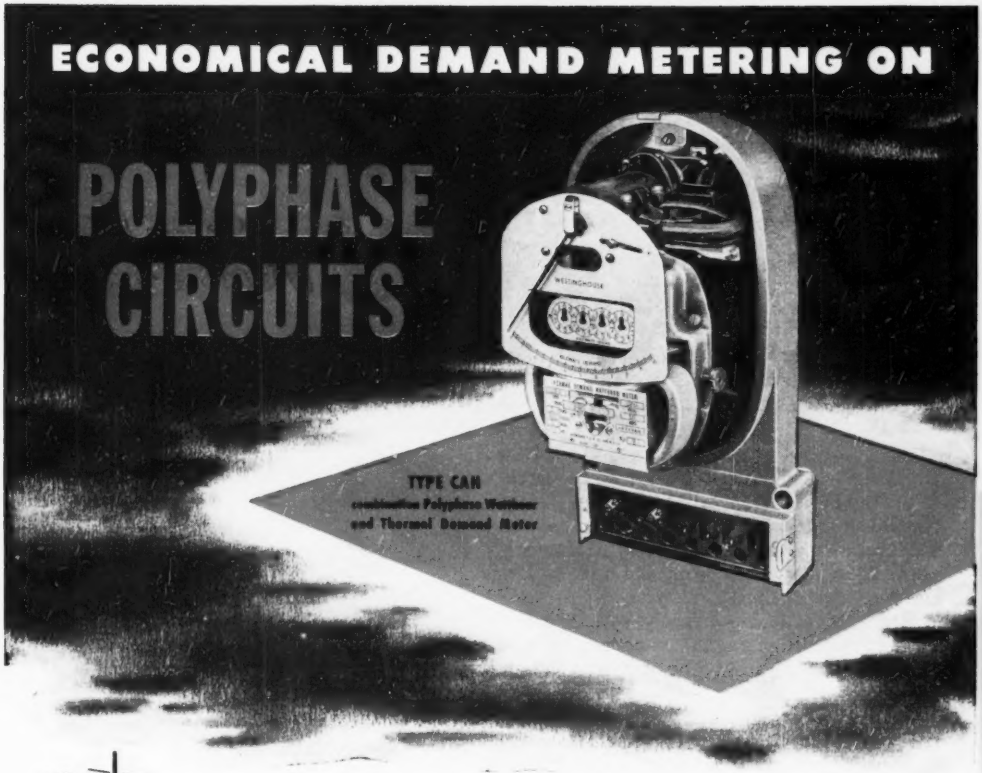
14

With this new alarm system, maintenance men need not be stationed at isolated points, just waiting for something to happen. Instead, they live in their home communities. This makes for better work . . . and better telephone service.

A B C D E F G H J K L M

BELL TELEPHONE LABORATORIES EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.

ECONOMICAL DEMAND METERING ON POLYPHASE CIRCUITS



...even where the load is small!

Here's your answer to the problem of low-cost demand metering on polyphase circuits . . . for the *full range* of loads.

YOU CAN BE SURE.. IF IT'S Westinghouse

New, low-cost Westinghouse polyphase Demand Meters combine a standard polyphase Watthour Meter and a Thermal Demand Meter into *one* compact unit. Their inherently low maintenance characteristics make possible the sound economy of demand metering on small *or* large loads. Only one mounting is required . . . taking up little more space than one three-element polyphase Watthour Meter. Installation is greatly simplified. A low first cost is made possible through simplified design.

Whatever your requirements may be . . . kw *or* kva demand meters . . . single-phase or polyphase . . . Westinghouse has the meter that will give you the *accurate* and *economical* information you need. For complete information call your nearest Westinghouse office or write for C. S. 42-338, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40364

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Watthour and Demand Meters for Any Job

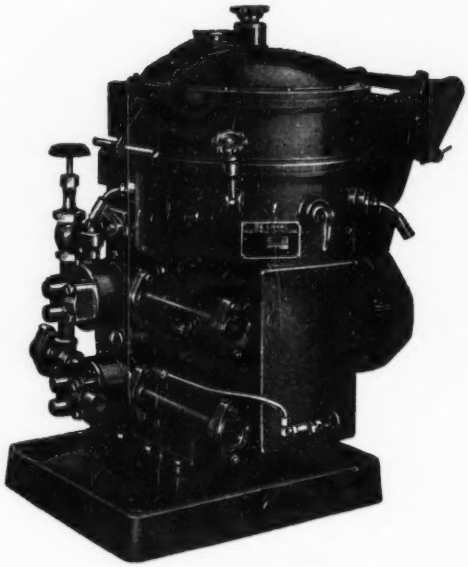
WHEN DO I PAY FOR MYSELF ?

"I am De Laval Centrifugal Force. Working in a De Laval Oil Purifier, I nip trouble in the bud. I protect your power unit from impurities in the lubricating system. I may save you more than you can ever determine!"

Bearing trouble — usually synonymous with lubricating trouble — comes at unexpected or inopportune times. When you get a warning, it is too late.

A De Laval Oil Purifier removes by centrifugal force both of the trouble makers in lubricating systems — water and dirt, or sludge. On continuous by-pass, it keeps the oil in a condition so pure that it can best be compared with new oil. Hence an adequate supply of purified lubricant is always available, and the danger of bearings being "frozen" is reduced to the vanishing point.

The number of bearings saved — or the amount of "down time" avoided — is difficult to evaluate precisely in such cases, just as it is impossible to evaluate a lightning rod in a storm. The chances are that many, many times in the course of a year a De Laval serves to avoid serious trouble, or even a complete shutdown of power-generating facilities. In other words, sooner or later your De Laval will pay for itself.



Model 67 "Uni-Matic" Oil Purifier

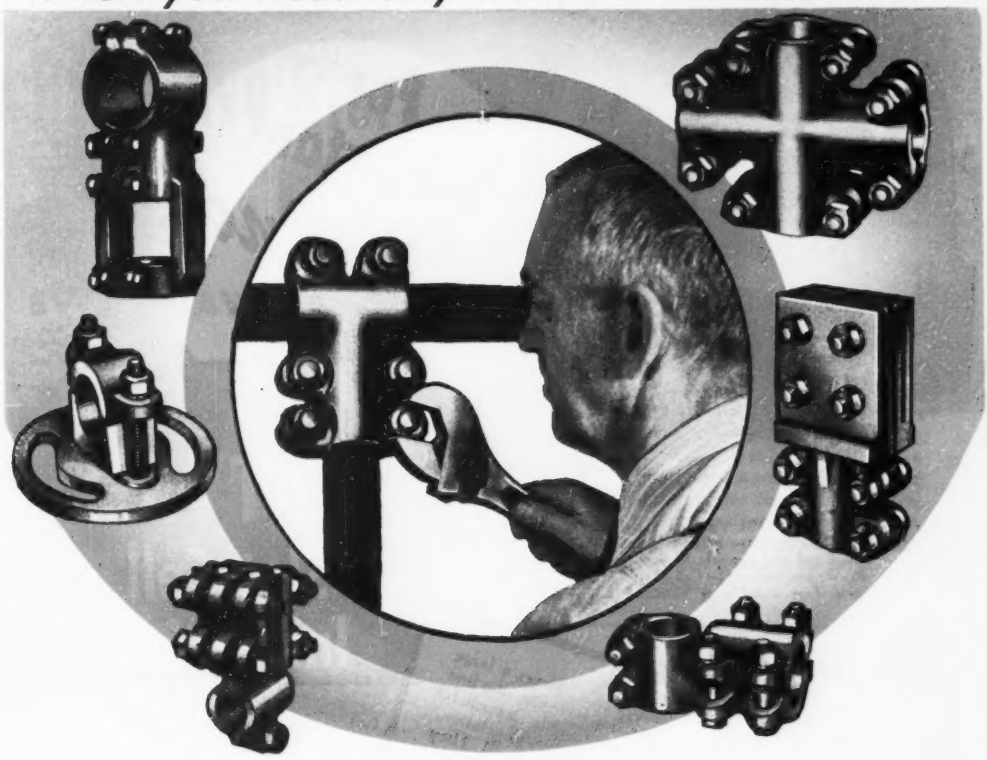
The "Uni-Matic" is an integral oil purification unit consisting of Oil Purifier, pumps and — when desired — heater. Several sizes available.

De Laval

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

OIL PURIFIERS *for more dependable power production*

When you need any **POWER CONNECTOR—**



—see the *Complete* line

Probably the exact Power Connector you want is one of the standard Penn-Union items. You will find Tee and Stud Connectors and Solderless Terminal Adapters, Bus Supports, Terminals, Elbows, Cross Connectors, Couplers, Reducers—each in a wide range of sizes, up to the largest.

Also the **complete** line of Service Connectors, Cable Taps, Straight and Parallel Connectors, Grounding Clamps — every good type of conductor fitting. Penn-Union connectors are the first choice of experienced users, because of their **known dependability**, mechanically and electrically.

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

Canada: Dominion Cutout Company, Ltd.

250 Richmond St. West, Toronto

THE *Complete* LINE OF CONDUCTOR FITTINGS

PENN-UNION

For Important *Rewind* Jobs—

NATVAR Slot Cell Insulation

Rewinding a 700 H.P., 900 RPM, 3 phase, 60 cycle, 6900 v., type ATI, G-E Synchronous Motor calls for painstaking skill, good shop equipment and good materials. In rewinding this big boy, Braunlich-Roessle used Natvar Slot Cell Insulation, Natvar Varnished Cambric Tape and Natvar Varnished Fiberglas Sleeving.

The Braunlich-Roessle Co., Pittsburgh, Pa., serves a large industrial area, and their motor repair shop has enjoyed a fine reputation for competent work for 34 years. To Mr. Braunlich, a past president of National Industrial Service Association, all rewind jobs are important, whether large or small. They use Natvar Slot Cell Insulation, and other Natvar insulations, because they know they can depend on their uniformity and satisfactory performance in the completed job.

Natvar Slot Insulation is composed of 100% rag paper stock to which a layer of Natvar V.C. is firmly bonded. This combination of the high dielectric strength and moisture resistance of Natvar V.C. with the toughness and abrasion resistance of 100% rag paper makes a rugged slot insulation which withstands pounding and chafing without impairment of electrical properties.

Prompt deliveries can be made from your wholesaler's stock or direct from our own.

Natvar

Natvar Products

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished silk
- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Slot insulation
- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded vinyl tubing and tape
- Extruded vinyl identification markers

Ask for Catalog No. 21

THE NATIONAL VARNISHED PRODUCTS Corporation

TELEPHONE
RAHWAY 7-2171

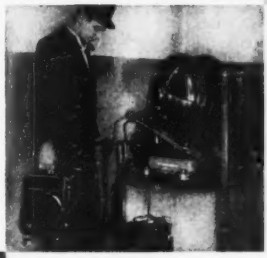
CABLE ADDRESS
NATVAR: RAHWAY, N. J.

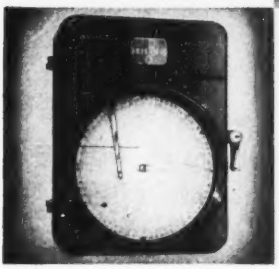
221 RANDOLPH AVENUE ★ WOODBRIDGE, NEW JERSEY

ILLUSTRATION FOR A

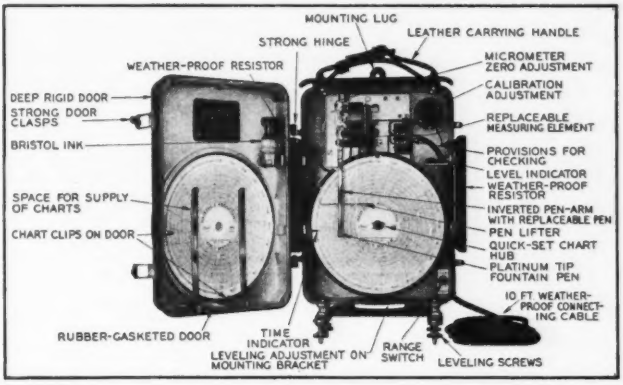
Detective Story

WITH A "PAY-OFF" EVERY DAY





You can put Bristol's All-Purpose Portable Recording Voltmeters and Ammeters *wherever* you need to get a clue as to what's going on in your power distribution system. The instruments are light, compact and weather-tight, suitable for portable service, indoors or out, for pole mounting, wall mounting or in damp cellars and manholes. Models available for permanent mounting on walls, panels and switchboards.



Many thousands of Bristol Electric Recorders—voltmeters and ammeters—are doing "detective work" under every kind of operating condition, helping—with famous Bristol accuracy—to uncover the facts needed for fast, efficient trouble-shooting. Many of the most progressive electric companies use them.

THREE PORTABLE MODELS

SINGLE PEN. Inexpensive instrument for quickly analyzing conditions, investigating complaints, making surveys, general testing, etc.

DOUBLE PEN. Records two different voltages or currents in two separate circuits simultaneously on one chart.

TRIPLE PEN. Records three different voltages or currents in three separate circuits simultaneously on one chart.

Many ranges carried in stock for immediate delivery.

Write for Bulletin E1100, giving full facts on Bristol Ammeters and Voltmeters, THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 91, Conn. (The Bristol Co. of Canada, Ltd., Toronto, Ont.; Bristol's Instrument Co., Ltd., Lynch Lane, Weymouth, Dorset, England.)

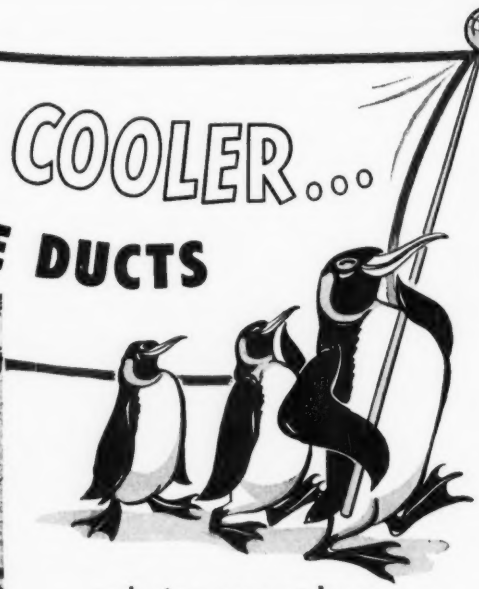
60 YEARS...1889-1949

BRISTOL

Gives You the FACTS When and Where You Want Them

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Cables run COOLER...
in TRANSITE DUCTS



. . . reducing copper losses
. . . increasing current capacity
. . . prolonging insulation life

YOU REDUCE copper losses . . . increase current carrying capacity . . . and prolong insulation life, when you run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 290, New York 16, N. Y.

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV (6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%
Earth Temp. ambient—20 C

	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric loss (C)	1.9	2.1
Allowable Rise for Copper loss (C)	59.1	58.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365.
Allowable Current—(Relative %)	105.6	1.00.

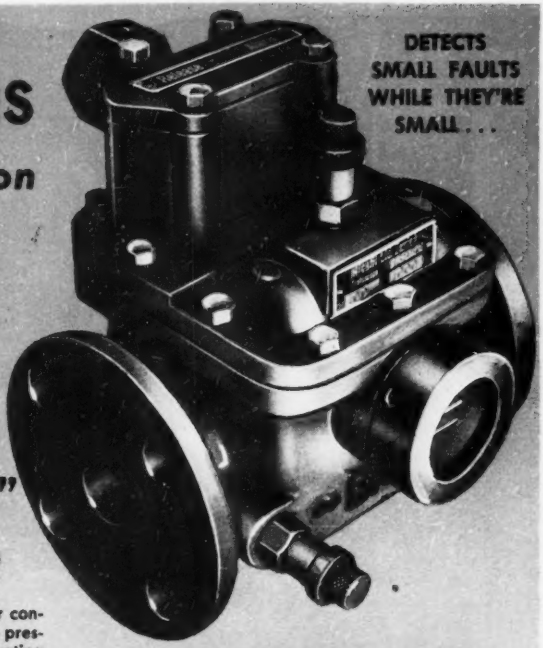
Johns-Manville *Transite Ducts*

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

Give Your TRANSFORMERS Continuous Protection with the Continuous CHECK-UP of the "TRAFOSCOPE"

(GAS ACTUATED RELAY)



DETECTS SMALL FAULTS WHILE THEY'RE SMALL . . .

The Trafoscope is a device primarily intended for conservator type oil-filled transformers. It detects the presence of gases and is, therefore, suitable for indicating all internal faults and abnormal operating conditions which produce excessive over-heating of oil or insulating materials.

Besides giving protection against electrical faults, the gas relay indicates the presence of extraneous air in the oil, excessive lowering of the oil level and faulty oil circulation.

The most important quality of the gas relay is that it is cumulative as well as instantaneous with the result that it will signal small but persistent faults or slow deterioration long before they have assumed dangerous proportions, besides sudden defects.

It is positively proved that the use of this type of relay results in less damage before detection and therefore in less outage for, and cost of, repairs than if other types of protection had to be depended upon exclusively.* Standard for transformer protection all over the world for years. Now available in original design in the United States.

3 Sizes — prompt shipment from stock in New York.

● *This is only one example of the complete line of electrical and mechanical equipment produced by Brown Boveri, which is famous all over the world as one of the foremost manufacturers of mechanical and electrical power equipment.*

*AIEE Transactions 1947 p. 1052, 1058

TRANSFORMER FAILURES DETECTED BY THE TRAFOSCOPE

a) Puncture of bushing
b) Internal short between phases
c) Internal earth fault
d) Winding short
e) Short between tappings; metallic or flashover
f) Interruption of phase; owing to fracture of wire or bad contact within the ratio adjuster
g) Shorted laminations and broken down core bolts
h) Group of coils shorted
i) Corona discharges in poor oil
j) Short circuit at crossing point of parallel windings
k) Short on the line causing thermal overload of the transformer in case of failure of short circuit protection
l) Oil level drops below safe limit owing to leakage
m) Oil level drops owing to intense cold
n) Entrance of air from circulating system and other causes
o) Air released immediately after installation

BROWN BOVERI CORP., 19 RECTOR ST., NEW YORK 6, N. Y.

Progressive Engineers — Skilled Craftsmen — for Over 50 Years

BROWN BOVERI

SWITCHGEAR	REGULATORS	RELAYS	MOTORS AND TRANSFORMERS	TURBINES
• Air Blast Breakers • Oil Circuit Breakers • Power Disconnects • High Speed DC Breakers • Current Transformers • Voltage Transformers	• for Voltage AC and DC • Current • Frequency • Power Factor • Paper Machines • Turbine governing	• Current, Voltage, Power • Thermal • Differential • Ground Fault • Distance • Buchholz	All Type Motors • constant & variable speed All Size Transformers • fixed ratio & load tap changing	• Gas Turbines • Steam Turbines • Marine Turbines • Centrifugal Compressors • Axial Blowers • Turbo Chargers

Yes-we have a fountain of youth

ONE of those early explorers came to America to find a Fountain of Youth. But he never found it. We, on the other hand, have never looked for a Fountain of Youth—but we have found one.

The way we look at it, a company exists only so long as it serves the needs of its customers. When it falls too far behind, it fails. That is part of the American tradition of Free Enterprise.

Kerite customers have brought their problems to us for 90 years. And we have done our best to solve them. That keeps us young. And it keeps our customers coming back. As long as people do bring us their problems, we have a Fountain of Youth. We think that is as it should be. We will continue solving problems just as long as we can.

One problem that was solved a long time ago was that of developing an insulation that would stand-up-no-matter-what. Mr. A. G. Day solved that one back in the 1860's when he developed Kerite. We can show you samples of Kerite cable more than 50 years old that are still in first-class condition! The Kerite we build today uses the same formula. It is just about the longest-lasting, most economical insulation around. It stays young, too! The Kerite Company, 30 Church Street, New York 7, N. Y.

Kerite Insulation—Your Cable's Best Life Insurance

DAYS KERITE

KERITE CABLE

The Income Statement

THE STEEL COMPANIES of this country and the United Steel Workers of America have recently been presenting their views regarding a wage increase before the fact-finding commission. Among the most important subjects in the debate is the question: Are earnings of the steel companies large enough to permit a wage increase? The union, represented by Robert Nathan and others, claims that wages can go up without a price increase. On the other hand, the steel companies see that earnings are dropping and may be much lower at a time that wages might increase. Under these conditions they obviously cannot agree that earnings are more than sufficient for stockholder requirements or that higher wages would not require immediate price increases.

The question, then, in the steel dispute is: What are the earnings in relation to prices, wages, and stockholder requirements?

This same problem haunts the electric utilities. It is particularly important during a period of rapid expansion, when increased earnings are essential to carry the capital investment. But utilities do not publish monthly income statements that refer earnings to related items such as property or capitalization. Many of the statements do not even show earnings per share to indicate effect of new issues.

A recent utility income statement shows June net income up 130% over 1948 with gross income up 58%. On the face of it, one would think that earnings were going far beyond a reasonable rate of return. The public and most of the employees will have the impression that there is a lot of excess fat for someone to gather.

The gross earnings of this company were 0.4% of capitalization in June, 1949, compared with 0.36% in June, 1948. Obviously on a 12-month basis, this is a low return. Data for the 12 months ending June 30, 1949, show a return on capitalization of 6.52%—for a year earlier, 6.28%.

The only conclusion that can be arrived at is that the almost fantastic increases in earnings of 58% and 130% give a completely false picture. The earnings of utilities should be related to a realistic base to prevent misconception by the public. Such statements that are distributed to the employees and the press, and certainly all of them should be, need an overhaul. The basic problem is simple. What are earnings? What is the significance of earnings? Operating income, gross income, net income, or profit have no significance without some clearer terminology or relationship to something tangible. It could almost be said that the word "profit" has no use in a regulated industry which is not allowed to keep more than the minimum needs for financial stability. Certainly the terms net income and gross income are without use to anyone except the accountant.

In spite of certain objections, it seems that earnings related to rate base, capitalization, and common stock would give the best picture to the public. This is a great opportunity to carry the ideas now being accepted in annual reports into the monthly and quarterly statements. Everyone would profit by this move.

Why Rate Experts?

IN THE COLUMNS of ELECTRICAL WORLD, we recently called attention to a new organization offering a service of audit and analysis of utility bills. This new concern attempts to sell its service upon the grounds that "public utilities are not legally responsible for seeing that each customer gets the lowest rate available to him." It claims to give the client a "study designed to uncover over-charges, incorrect billing methods, erroneous interpretation of contracts, improper metering methods, and misapplication of rate schedules as well as to find the lowest-cost rate."

There are other organizations providing engineering and advisory services for electric consumers. Some of these firms have been in business for a long time. Their record of performance on behalf of their clients has, we presume, justified their existence. Certainly they could not continue to exist if they were not supplying something for which the client is willing to pay. Assuming that most of these services are available from the utilities, there must be a reason for outside assistance.

We will not attempt to discuss this subject. But we do believe that each utility should review the problem. Whether customers feel the need for outside audit may be a secondary matter. The significant elements relate to the degree of confidence which the customer has in his power supplier, the knowledge he has of similar services available, and the frequency of contact by the sales representatives.

Should Employees Get Discounts

A MEMORANDUM to retailers on the subject of discounts to utility company employees recently came to our attention. It gives such a logical reason for allowing the discount that we feel extracts will be of interest to the industry at large. The letter states the case as follows:

"——Co allows its employees to buy appliances at a discount because it wants to give them a break. We can all understand that.

"It wants its employees to feel that they are a real part of the industry—sort of on the inside—the same as you want your employees to feel.

"It wants to encourage the use of appliances in the homes of its employees. It wants them to be good examples of people who believe in Electrical Living. That's a natural way for a power company to feel. And that's the practice which most of the power companies throughout the country follow.

"Incidentally, the enthusiasm of a Power Company employee and his family over a new electrical appliance, which they have just bought, creates a desire on the part of the neighbors for a similar piece of equipment—and this results in more business for the dealers."

In conclusion the letter points out the safeguards against misuse of this plan, which seem to be entirely adequate.

Others might give the problem careful consideration. It is good public relations.

New England Speaks

WE RECENTLY presented both editorially and factually the conflicting statements about the power situation in New England. In our editorial we called for a simple presentation of the facts to the citizens of that locality. And, as the saying goes, "no sooner said than done." almost immediately a copy of "The Electric Power Situation in New England" came in.

This booklet, which explains the power picture in simple and clear terms, was prepared and distributed by R. H. Knowlton, president of the Connecticut Light & Power Co. It is not only applicable to the New England situation, it presents the whole problem of comparative cost of power in various areas. The booklet also illustrates the minor effect of power cost on industrials.

We hope that it is used widely by the utilities in New England. But it should not be overlooked as a useful tool for the industry as a whole.

We Hit The Jackpot

THE COLUMNS of ELECTRICAL WORLD are frequent hosts to stories about the American system of free enterprise. Recently we reported on a new comic booklet entitled "We Hit the Jackpot" by General Comics, Inc. This is one of the best publications of its kind that has been written to date. It presents the story of America in such clear and simple terms that all ages can understand and enjoy.

In its conclusion the hero, one Joe Jackson, factory worker, summarizes our economic system in these terms:

Workers—Free to change jobs if they choose, get a fair wage or get another job . . .

Stockholders—Free to invest their savings where they choose, get a fair return or invest in another company . . .

Customers—Free to choose how they spend their money, get a fair value or buy another product . . .

Then Joe Jackson finds that all three are the same person and our hero fits each description.

To date, about 225 companies have purchased the book for distribution to employees. It is reported that hundreds of thousands of copies have been distributed. These have gone to schools and civic organizations as well as directly to employees of industry. Of course wide distribution is not in itself a test of effectiveness. But it is proof enough that the utilities who haven't already used it should seriously consider such an idea.

The Electrical Week

When *Rural Electrification*, official publication of the National Rural Electric Cooperative Association, carried an article charging various utilities with being unable to provide adequate power supply and satisfactory service, ELECTRICAL WORLD wrote to the presidents of the utilities named. Their replies are a denial of the charges . . . Control operators are supervisors, the U. S. Circuit Court of Appeals has ruled in a case involving Ohio Power Co. Important to all utilities and manufacturing companies is the definition of a supervisor. He need not have all the authority usually possessed by a supervisor but just a portion of it. What is more, he need not exercise this authority at all times. If he exercises it in emergencies only, the man is still a supervisor . . . And the Federal Power Commission has agreed to reconsider the Interior Department's petition to intervene in Virginia Electric Power Co's application for a license to build a hydro project at Roanoke Rapids.

When the National Electrical Wholesalers Association changed its name to the National Association of Electrical Distributors, one member wisecracked, "I'm for it because my retail business has been so bad."

The idea that windmills can generate electricity won't blow away. At the United Nations Scientific Conference, the suggestion that aerogenerators be used to supplement hydro installations was brought up again.

It is with no disrespect that we put Charles E. Wilson, president of General Electric Co. in the class with the dodo. With industry getting its executives from college graduates who begin work after the age of 20 and retire at 65, there will be few industry executives of the future who can match his record of more than 50 years with one company.

Look for increasing resignations among Engineer Corps officers and civilians working on civil projects. Morale of the Engineers has sagged seriously under press and Congressional attacks charging the Corps with "lobbying" and "inefficiency." What hurts most, though, is that the Engineers are under orders not to reply to such charges.

One Southeastern utility, hit slightly by the edges of the recent Florida hurricane, had more trouble with overzealous party-goers than with storm damage. Only after prolonged debate—in the wee, small hours of the morning—could the company's line crew persuade the revelers that it needed no help in clearing a tree-fouled circuit.

Reclamation Bureau will ask Congress next year to let it pool power costs, revenues, and accounts of all Missouri Basin projects. Idea is to make most economic developments help carry costs of marginal jobs —and to simplify federal bookkeeping.

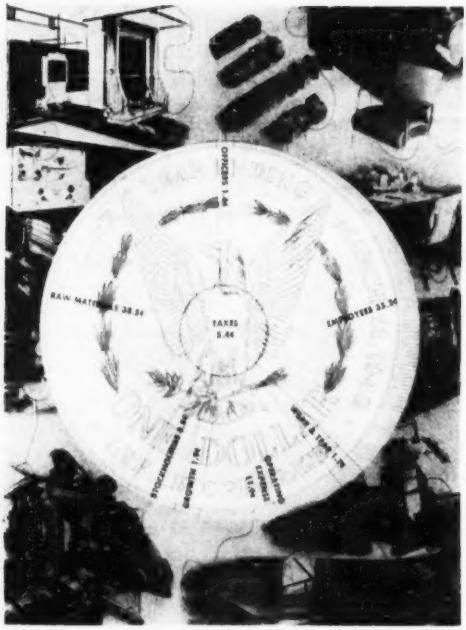
The National Association of Broadcast Engineers and Technicians is considering affiliating with the CIO. The reason is to get backing for its fight to survive against the IBEW in the radio and television studios.

Notes From The News

Nine miles of aluminum conductor cable have been ordered by the State Electricity Commission of Victoria, Australia, for the "longest high-voltage power line span in the world." The cable will be used for the six conductors of the 22-kv Kiewa-Melbourne transmission line across Eildon Reservoir, to stretch in an unbroken span of 7,300 ft . . . Federal Power Commission has authorized Central Power & Light Co, Corpus Christi, Tex., and Luz y Fuerza de Reynosa, Tamaulipas, Mexico, to transmit up to 6 million kwhr of power annually from the United States to Mexico . . . The foundation has been laid for a $500,000 electrical engineering wing for the University of Massachusetts School of Engineering's main building. It is scheduled to be completed by September, 1950.

By the end of 1950 the Consolidated Edison system expects to have spent $20,956,200 on smoke abatement since April, 1937. . . A 15-month course in television repair and maintenance will be started for inmates of the Illinois State Penitentiary at Joliet this fall. . . A group of citizens is opposing construction of the $25-million power plant Union Electric Co plans to build in southern St. Louis County, Mo., at the mouth of the Meramac River. They claim the plant will constitute a health menace because of possible fly ash emission. . . Western Berlin's power, gas, water, and sewage facilities were returned to German control, Aug 30, for the first time since the city fell in 1945. . . A new Bell System coaxial cable has been placed in service between New York and Philadelphia. In addition to serving the two cities, the cable will link with existing cables to form channels for additional telephone and video facilities to the South and West.

—Continued on following page—



SENSE OF TOUCH is utilized by ATF, Inc, to demonstrate the economics of American business. Center of the 28-piece jigsaw cutout sent to all employees of ATF and its subsidiaries shows breakdown of the 1948-49 company income dollar. Surrounding photos illustrate ATF products. Jigsaw device emphasizes that the company picture can't be complete with even a single piece missing

Manufacturers and Markets:

Refrigerator manufacturers, who last spring cut back production because of a slump in sales, are now stepping up output. A sharp upsurge in sales in June and July cut into inventories in manufacturers' and dealers' hands. GE and Philco are allocating boxes to distributors because of short supplies. The National Appliance and Radio Dealers Association stated that refrigerators will be in short supply until October, but by December supplies will be plentiful . . . Manufacturers' sales declined in July, partly as a result of vacation shutdowns, the U. S. Department of Commerce has announced. July sales of all manufacturing companies were estimated at $15 billion, compared with $16.5 billion in June, the decline being about the same as a year ago. Sales of durable-goods manufacturers fell from $7.1 billion in June to $6.3 billion in July. The iron and steel and electrical machinery industries were most affected . . . The British Ministry of Supply has temporarily suspended sales of tin for export. The action was taken to realign official policy to resumption of tin purchases by U. S. importers. The Commerce Department, as previously announced, revised its basic tin control orders and among other things allowed U. S. importers to buy all grades of foreign tin.

Financial:

Holders of the $5 and $2.50 preferred stocks of Pennsylvania Edison Co are entitled to "premium" prices for their shares in liquidation of the company, the Third United States Court of Appeals has ruled. The decision also called for interest to date on payment of such premiums. Associated Electric Co, Pennsylvania Edison parent, had contended the stockholders were entitled only to liquidation prices. . . Union Electric Co has asked Missouri Public Service Commission permission to acquire $6 million worth of common stock of Union Electric Power Co, its subsidiary. The money would be used to help finance an addition to the latter's Venice, Ill., No. 2 plant. . . As part of the financing of its $88-million expansion program, Arkansas Power & Light Co has asked Public Service Commission approval of an $8.7 million issue of first mortgage bonds.

The Texas Secretary of State has okayed an amendment to the charter of Texas Electric Service Co permitting the utility to issue an additional 2 million shares of common stock . . . Hartford Electric Light Co stockholders have approved immediate issue of $8 million of preferred stock. The issue had already been filed with SEC . . . FPC has authorized Holyoke Water Power Co, Holyoke, Mass., to issue $5 million in 3% debentures, proceeds of which will be used to finance construction of the company's projected power station . . . Montana-Dakota Utilities Co, Minneapolis, has received Federal Power Commission authorization for issuance of $1.5 million in $3\frac{1}{8}\%$ first mortgage bonds, due in 1972.

Construction:

It took more than 42 freight cars to transport the 1,318 tons of boiler steel required for one boiler in Pacific Gas & Electric Co's new steam-operated generating plant at Moss Landing, Calif. Six boilers will go into the $51.5-million, 402,000-hp plant, which will be one of the two largest on the company's system. . . . Construction work on Oklahoma Gas & Electric Co's $19-million Mustang power plant was crippled when 14 steamfitters went on strike over a wage dispute. . . . Sen A. Neil McLean, Canadian "sardine king," expressed strong opposition to the proposed plan to develop electric power by harnessing the tides of Passamaquoddy Bay. He appeared before the International Joint Commission, meeting in St. Andrews, N. B., to determine whether the cost of a full-scale investigation into the project's merits is warranted. McLean, who was chiefly responsible for defeating Canadian participation in the "Quoddy" development 20 years ago, maintained the project would cut off the sardines' source of food and destroy fishing at Blacks Harbor.

Are Cooperatives Short of Power?

Yes, Asserts *Rural Electrification*, and Power Suppliers Are at Fault;

No, Reply Utilities, Claiming Their Service to Co-ops Is Satisfactory

The August issue of *Rural Electrification*, official publication of the National Rural Electric Cooperative Association, carried this article. "Rural Electrics Still Need More Power. Facts from Widespread Areas Indicate Power Shortage Remains Critical." In the article some utilities are charged with failure to provide adequate power supply or satisfactory service. But there are no statements from the utilities giving their side.

ELECTRICAL WORLD has written to the utilities mentioned. All but two had responded when this was written. Without comment EW prints the assertions from the article and the pertinent parts of the replies from the utilities.

Rural Electrification:

"Florida co-ops have been experiencing a shortage coupled with excessive wholesale power rates from suppliers. Both Florida Power Corp and Florida Power & Light Co have dropped certain loads during the past two years. Neither, at the present time, has excess power to sell the rural systems for their expanding loads. All systems report that voltage conditions are poor and have become progressively worse during the past year and a half. The rural electrics have been forced to make plans to secure expensive voltage regulation equipment to remedy this situation after suppliers refused to do anything about it."

Reply by J. F. Bailey, vice-president, Florida Power Corp:

"There has been no shortage of power as far as the Co-ops located on Florida Power Corp lines are concerned. The only loads that the corporation has dropped during the past two years have been loads served under off-peak and interruptible contracts.

"We have had a little voltage trouble over the noon peak in northwest Florida, usually about 30 minutes around 11:30 A.M. We have advised all of the Cooperatives that they should install regulators to insure satisfactory voltage to their customers out on their long lines; that it is our standard practice to install regulators at all substations, and that in our opinion the investment in regulators pays off in additional revenue as well as in better service.

"The rates during 1948 and the early part of 1949 were high, due to the high cost of fuel oil; however, our fuel adjustment has dropped from 5.4 mills to 1.5 mills, and we have also reduced our rate base approximately 2 mills per kwhr, the present rate to cooperatives being $1 per kw demand monthly basis, 5 mill energy and 15/100 mill fuel adjustment, for each 5¢ increase in the price of oil above $1.05 per bbl f.o.b. Port Tampa. . . . We are now selling them power at a rate that will not give us a fair rate of return."

Reply by Robert H. Fite, vice-president, Florida Power & Light Co:

"Our power supply has always been adequate to take care of the requirements of the three cooperative systems served by our company. We have accommodated all past increases in load and plan to take care of all foreseeable increases. We have never dropped the load of any cooperative due to inadequate power supply and do not foresee any occasion to do so.

"We have received no complaints of poor voltage conditions from any of the cooperatives that we supply. As far as we know, none of them is planning installation of voltage regulating equipment, although eventually the co-ops will undoubtedly find it desirable to do so as their lines lengthen and loads increase. This, of course, is simply standard utility practice.

"Bills (to the three co-ops) last month totaled $3,015.22, or an average of 11.83 mills base rate plus 1.78 mills per kwhr for fuel adjustment. We have recently offered these co-ops a lower rate, which, based on last month's billing, results in an average of 8.47 mills per kwhr base rate plus 1.78 mills per kwhr for fuel adjustment. This is a reduction of 24.7%.

Rural Electrification:

"In Georgia, six systems, now served by Georgia Power & Light Co, have received assurance that their power problem will be improved by respective 'three-way' agreements where Georgia Power will supply GP&L with sufficient power to take care of the co-ops' needs. But for the past two years their power suply has been precarious with inadequate service and limits on demand."

Reply by J. F. Bailey, president, Georgia Power & Light Co:

"All of the (six) cooperatives have had all of the capacity they required except the Okefenoke REMC at Nahunta. We have recently doubled the voltage on the line serving this area, and the Cooperative has taken some of its power from the Georgia Power Co lines radiating out from Brunswick. From a capacity standpoint there is no longer any question of adequate supply.

"We have had some voltage trouble in southwest Georgia, and the Cooperatives have been advised to install feeder regulators as it is impossible to control transmission regulation on that system to provide adequate voltage on long feeder lines.

"We have been under considerable pressure during the past several years to get our rates in line with the Georgia Power Co rates, but it was impossible for us to do so without cooperation from Georgia Power since there was nearly 4 mills difference in production cost during 1948. A considerable amount of pressure was also put on Georgia Power, and we finally worked out a three-way agreement whereby it has agreed to furnish us with power for resale to the cooperatives at 6½ mills, and we in turn will resell to the cooperatives at 7¾ mills."

Rural Electrification:

"In Michigan, the Oceana Electric Co-op at Hart received a letter from the Michigan Public Service Co, dated Sept 2, 1948, stating that because of increased demands on its system, it was not in a position to sell additional power to REA-financed rural electric systems either now or in the future."

Reply by W. C. Blanchard, president, Michigan Public Service Co:

"Their lines were first energized under contract on March 10, 1939, and power supply by our company to the co-op continued until Aug 18, 1947, although, in the meantime, the co-op on two different occasions formally notified us of its intent to terminate the contract. But, as it turned out, on neither occasion were they ready to cease our supply.

"Under date of Sept 6, 1941, the Oceana Co-op, by its president, Mr Charles Kokx, notified us by registered

mail that a special meeting of the co-op directors held Sept 5, 1941, had authorized notice to us of their desire to cancel the above contract as of March 10, 1942.

"Acknowledgement of said notice was mailed by us Sept 8, 1941 . . . No further word was received from Oceana, and we naturally assumed they would cease taking power from us on March 10, 1942.

"However, a few days before March 10 our representative phoned the Oceana manager at Hart to make definite arrangements for the March 10 severance, whereupon the Co-op manager blurted out, 'Oh my G-d! Don't cut us off—we aren't ready yet.' (Reference was to contemplated hookup by Oceana Co-op with lines and supply from Western Michigan Co-op of Scottville.) On being reminded of their cancellation notice, the Co-op manager said, 'Yes, I know, but I'm not the directors—I'm just the manager.' So our company, not wishing to cause serious inconvenience or loss to the co-op members, continued to supply Oceana under the terms of the original contract although the Co-op never made any official explanation or apology nor did they offer any word of appreciation to us."

Four years later in a registered letter dated Sept 6, 1945, the co-op cancelled the contract as of March 10, 1946. Again the co-op manager called and asked the utility to continue serving the co-op. On June 7, 1946, Mr Blanchard declares in his communication to EW, he called the co-op manager and informed him that the utility wanted the co-op off its lines by July 10, 1946.

"Such was our experience with the management of the Oceana Electric Co-operative," said Mr Blanchard in his letter to EW. "We gave up in disgust but lest their members suffer for the acts of their directors or Washington advisers, we continued to supply them throughout 1946 and on Aug 18, 1947, final severance from our lines and supply was effected—this time without formality of notice or written communication from them."

In 1948 when the co-op again asked the company to supply power, "our reply dated Sept 2, 1948, was exactly as follows and not as quoted in their magazine article:

"The rapidly increasing demands of our system will not permit us to offer you wholesale power supply as inquired about in your Sept 1 letter."

Rural Electrification:

"The situation in Iowa is growing more serious daily. Rural electrics have been forced to curtail and, in some cases, discontinue service nightly over peak periods. This condition has forced the systems to resort to unusual measures to increase their power supply. A case in point is the Linn County Rural Electric at Marion, which is seeking a small block of 400 kw from Buchanan County Rural Electric at Independence for the coming winter months. Both systems now receive power from Iowa Electric Light & Power Co."

Reply by Sutherland Dows, president, Iowa Electric Light & Power Co:

"With reference to the statement 'Rural electrics have been forced to curtail and, in some cases, discontinue service nightly over peak periods,' this has been a practice for several years for individual cooperatives who receive power from cooperatives' generating stations. I have no knowledge of any cooperative's being forced to discontinue service over a peak period where it has been receiving service from a private utility.

Rural Electrification:

"In the Dakotas and Minnesota the Otter Tail Power Co, which now sells 25% of its generating capacity to rural electric systems, has notified the Dakota systems that it could not meet the systems' growing needs. This information was contained in a letter to the co-ops which was made public during the Interior subcommittee hearings in the Senate. Otter Tail recently applied for a rate increase for wholesale power sold to rural electrics, amounting to between 30 and 40%."

Reply by Thomas C. Wright, president, Otter Tail Power Co:

"The quotation is grossly incomplete, and, therefore, is grossly misleading. The ability to supply the REA is tied up closely with the construction of the Garrison Dam and with the matter of rates. We expect that Garrison Dam will be ready to deliver power by about 1954. At that time, we expect to lose substantially all of the REA busi-

Changes in Capacity Reported to Federal Power Commission

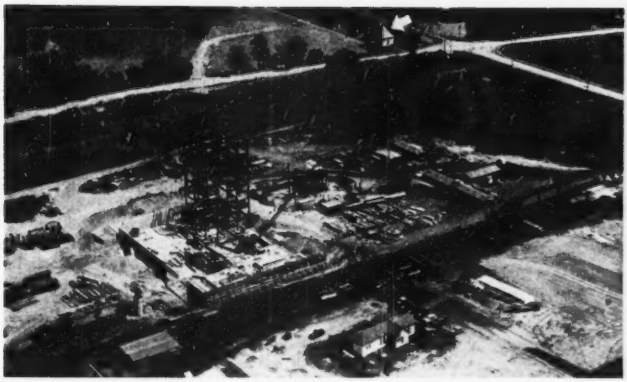
PLANT ADDITIONS DURING JULY

Utility	Plant	Fuel	Capacity (Kw)
Pennsylvania Electric Co	Warren	S	34,500
Miamisburg Light & Water Department	Miamisburg, Ohio	S	3,500
Rochelle Electric Light Plant	Rochelle, Ill.	IC	1,050
Altamont Electric Light Plant	Altamont, Ill.	IC	300
Board of Water & Electric Light Commissioners (Lansing, (Mich.)	Ottawa St.	S	25,000
Northwestern Wisconsin Electric Co	Frederic	IC	1,400
Northern States Power Co	Riverside, Minn.	S	60,000
Iowa-Illinois Gas & Electric Co (Iowa)	Riverside	S	40,000
Carthage Water & Electric Department	Carthage, Mo.	IC	2,555
Salisbury Municipal Utilities	Salisbury, Mo.	IC	240
Minkota Power Co-operative, Inc	Grand Forks, N. D.	IC	520
Chambers Light & Power Co	Chambers, Neb.	IC	15
Franklin Light & Water Plant	Franklin, Neb.	IC	435
Wauneta Municipal Utilities	Wauneta, Neb.	IC	360
Central Kansas Power Co	Hoxie	IC	600
Colby Water & Light Plant	Colby, Kan.	IC	800
Clay Center Light & Water Plant	Clay Center, Kan.	S	3,000
Kansas Power & Light Co	Blue River	H	600
Henderson Electric Light Department	Henderson, Ky.	IC	1,230
Henderson Electric Light Department	Henderson, Ky.	IC	1,230
Covington Light & Water Plant	Covington, Tenn.	IC	1,125
Alabama Power Co	Gadsden (new)	S	60,000
Houma Light & Water Department	Houma, La.	IC	4,230
Louisiana Power & Light Co	Oak Grove	IC	504
Pawhuska Light & Power Department	Pawhuska, Okla.	IC	192
Oklahoma Gas & Electric Co	Arthur S. Huey	S	3,500
San Antonio Public Service Board	Leon Creek	S	30,000
Central Power & Light Co (Tex.)	Nueces Bay	S	30,000
Idaho Power Co	Lower Salmon	H	15,000
Julesburg Light, Power, Water & Ice Department	Julesburg, Col.	IC	840
White River Electric Association	Meeker, Col.	IC	1,000
Citizens Utilities Co	Valencia, Ariz.	IC	3,680
Bureau of Reclamation	Coulee Dam (Wash.)	H	108,000
Bureau of Reclamation	Shasta Dam (Calif.)	H	75,000
Imperial Irrigation District (Calif.)	Steam Plant	S	20,000
Los Angeles Power System of the Department of Water & Power	Harbor City	S	75,000

PLANT RETIREMENTS DURING JULY

Rochelle Electric Light Plant	Rochelle, Ill.	IC	375
Commonwealth Edison Co	Oregon, Ill.	H	425
Carthage Water & Electric Plant	Carthage, Mo.	IC	850
Consumers Public Power District (Neb.)	Seward No. 7	H	150
Franklin Electric Light Plant	Franklin, Neb.	IC	135
Western Light & Telephone Co	Ness City, Kan.	IC	136
Ashland Water & Light Department	Ashland, Kan.	IC	100
Colby Water & Light Plant	Colby, Kan.	IC	144
Covington Light & Water Plant	Covington, Tenn.	IC	183
Idaho Power Co	Bellevue	H	600
White River Electric Association	Meeker, Col.	S	300

H—Hydro, IC—Internal Combustion, S—Steam.
United States capacity as of Aug. 1—Steam, 41,411,514 kw; Internal Combustion, 1,695,911 kw; Hydro, 16,177,628 kw; Total, 59,285,053 kw.



OVERSHADOWING PUBLIC SERVICE CO of Indiana's 500-kw hydro plant (arrow), built on the White River in 1924, the utility's new Noblesville steam plant eventually will produce 160,000 kw. Two 40,000-kw units are going in now; two others will be added

ness, and we cannot be expected to build power plants with a 30 year life for a load which will last only for a maximum of a few years.

"In regard to the rates, we believe that we are selling to REA's at a loss and that the REA load is being subsidized by our own retail customers. If the rate increase is granted in full, we will still not make what is considered to be a fair return on the property which can be allocated to the REA business. Consequently, in the area beyond the reach of Garrison Dam power, we do not think it advisable to take on any more REA business until such time as the rate becomes compensatory.

"The REA's operating in North Dakota have accepted the situation and are building their own power plant near Minot, N. D. They have prevailed upon Congress to advance the construction of certain transmission lines in North Dakota, so that the power from the Minot plant can be delivered to the Co-ops. Otter Tail Power, the generating Co-ops and the Bureau of Reclamation propose to enter into a three-way contract under which the generating Co-op will use the Bureau's transmission line and pay them a rental until such time as the Garrison Dam is ready and Otter Tail will wheel energy over its own lines to the customers of the generating co-ops."

Rural Electrification:

"In western South Dakota, the Black Hills Power & Light Co, which serves several rural electrics, has not been able to supply power to them in amounts sufficient to meet their needs."

Reply by J. B. French, president, Black Hills Power & Light Co:

"To date there has been no shortage of power in our territory. All REA's in this territory are being supplied with all of the power they have requested. Our present contracts with them have about one year to run, and we will have no difficulty in supplying their full demands up to the time of the expiration of their contracts. We are now discussing with them renewal of their contracts."

Rural Electrification:

"Public Service Co of Oklahoma and the Oklahoma Gas & Electric Co have shortages of adequate transmission facilities which affect the supply to systems, particularly Western Electric at Kingfisher."

Reply by Wright Canfield, vice-president, Public Service Co of Oklahoma:

"The statement referred to is obviously an error as far as Public Service Co of Oklahoma is concerned, because our service territory does not extend to the vicinity of Kingfisher.

"The Western Electric is a transmission co-op and does not serve any farm customers directly so far as we know. We are now serving 18 co-ops in Oklahoma at 41 points of interconnection. We have given the distribution coops interconnections at whatever points they requested, and have received no complaints from them regarding the adequacy of our transmission facilities."

Reply by George A. Davis, president, Oklahoma Gas & Electric Co:

"It is a fact generally admitted by rural electric co-operative managers that voltage conditions to customers on their systems are subnormal. In most cases these managers will also admit that the subnormal conditions are almost entirely attributable to lack of distribution line capacity and of voltage regulators on their systems. For propaganda purposes, however, it has been felt desirable by some state-wide co-operative associations, and by the National Rural Electric Cooperative Association, to throw the burden of consumer complaints upon poor service by the power company. This has led us into making frequent tests of our voltage conditions at points of deliveries to the co-operatives.

"In the case of the Kingfisher delivery points to the distribution co-op, our records disclose that satisfactory voltage conditions exist. The manager of the Cimarron Electric Co-operative (the Western Electric Co-operative is a super transmission co-operative not yet in operation) has stated that he is satisfied with our voltage conditions at Kingfisher and the other points at which his co-operative takes service from our system."

Rural Electrification:

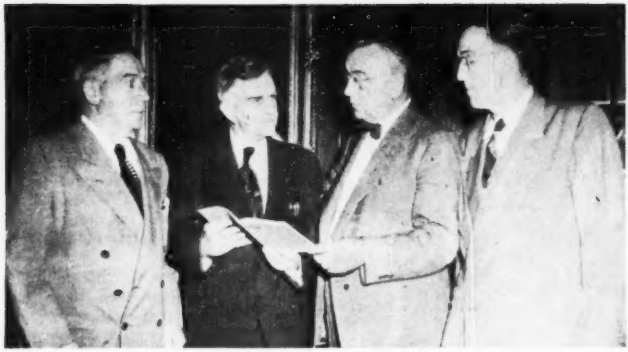
"Hanging over Kansas systems is a threat of curtailment of power in event of shortage from Kansas Power & Light Co, which supplies most of them under a rate and contract which has never received REA approval. The threat of such curtailment is serious because the company is short of generating facilities to meet the growing load. In its contract, KP&L also demands a 10-year contract and a restrictive dual rate."

Reply by D. E. Ackers, president, Kansas Power & Light Co:

"The facts are that Kansas Power & Light Co has provided energy to some of the electric cooperatives from the time of their initial operation in 1937. At present, the company supplies energy to 15 such cooperatives, and three others are negotiating with the company for their power. This represents all of the cooperatives operating in that portion of Kansas served by the company.

"The company has been able to meet the growing requirements of these cooperatives, including some instances where other sources proved inadequate. Furthermore, such energy is supplied at several points on the respective cooperatives' systems, which has made it possible for them to supply their increased loads without major alterations in their distribution systems.

"It should appear from this indication of the extent to which the local cooperatives have and are continuing to look to the company for their power requirements that the transactions over a period of years have been mutually satisfactory to the Cooperatives, as well as the Company."



NEW PRESIDENT of the Eastern Section, International Association of Electrical Inspectors, assumed office at a recent meeting in Boston. He is Bernard B. Whelan, superintendent of electrical inspection, Boston, third from left. Others above are, l to r, B. F. Greene, New York City, first vice-president; B. A. McDonald, Rochester, N. Y., retiring president; and Leonard J. Wylie, Hartford, Conn., second vice-president. Covered at the three-day meeting were developments in circuit breaking, and hazards of wiring applications as well as code specifications

Circuit Court Upholds Ohio Power; Control Operators Are Supervisors

Ohio Power Co has won in the U. S. Circuit Court of Appeals its dispute with the CIO Utility Workers over the union's right to bargain for control operators at Tidd Plant, Brilliant, Ohio.

The court's action came as the company and union were negotiating new one-year contracts covering three plants at Brilliant and Philo, Ohio, and Power, W. Va. Local union memberships this week were expected to ratify the new agreements containing a general wage increase of 4½¢, some correction of wage inequalities, and other benefits.

The decision upset an order in the union's favor by the National Labor Relations Board. As a result, NLRB will have to broaden its interpretation of supervisors who are exempt from the Taft-Hartley Act unless its seeks and and wins a reversal in the Supreme Court.

If the precedent-making decision stands, employers will have the right to keep more borderline supervisors out of the production worker bargaining group as well as deny them union bargaining privileges.

The court made two major points:

1. To be classified as a supervisor, a worker need possess not all but any one of the authorities listed in the definition, such as authority to hire, to lay off, to promote, to direct, to discipline or discharge employees, or to be able to recommend such action.

2. Authority or "responsibility to direct" other employees need not be exercised continuously or frequently, so long as that power exists.

In the Ohio Power dispute, the issue revolved around Point 2. The question was whether control operators were "supervisors" if they directed other employees only in emergency situations.

NLRB said, "This sporadic and infrequent exercise of authority is insufficient to invest him with the 'supervisory' cloak contemplated (by Taft-Hartley)."

The court replied: Responsibility to direct "does not require the exercise of the power described for all or any definite part of the employee's time. It is the existence of the power which determines the classification. That power to responsibly direct exists (among Ohio Power control operators) is uncontradicted."

NLRB had asked the court to enforce its decision ordering Ohio Power to bargain with the CIO union in regard to power plant employees, including four control operators. The court held that the utility was not guilty of refusing to bargain. It also directed NLRB to amend its classification of the bargaining unit to bar control operators.

The utility's insistence that it would not include the control operators in the bargaining unit sought by the union and approved by NLRB led to a five-day strike in April, 1948. The strike ended with the union's accepting the company's proposal to include control operators if the courts upheld NLRB.

Olds Facing Opposition in Senate Subcommittee

The Senate has won another round in its small-scale feud with President Truman over reappointment of Leland Olds to the Federal Power Commission. But the end of the battle is not yet in sight.

The Senate Interstate and Foreign Commerce Committee last week named a subcommittee to conduct hearings on the Olds nomination. The subcommittee, headed by Sen Lyndon Johnson, Texas Democrat, included not a single supporter of the appointee. Hearings, Senator Johnson said, will start "within a few weeks."

There is little likelihood that the subcommittee will speed the hearings. It probably will report on the appointment before the end of the Congressional session, however. That would permit the full committee to vote on Olds. An unfavorable committee vote would bar the President from giving Olds an interim appointment after adjournment.

Other members of the Johnson subcommittee are Senators McFarland of Arizona and Johnson of Colorado, both Democrats, and Republicans Reed of Kansas and Bricker of Ohio. Chairman Johnson reportedly is among the Senators who attempted to persuade President Truman to withdraw the Olds appointment.

Meanwhile FPC functions with only four members.

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Co-ops Squawk; Increase in Assessment Lowered

The Tennessee State Railroad and Public Utilities Commission's attempt to increase the 1949-50 property assessment of the state's 24 electric cooperatives from $5,057,000 to $21,848,200 brought such a howl the PUC was forced to cut it back to $6,677,650.

Many of the co-ops said that if they were forced to pay taxes on such assessments they would have to cease operations. The original increase of 320% was made on Attorney General Roy Beeler's ruling that the law exempting co-ops from taxes on new construction for the first four years was unconstitutional.

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Frederick Holz Dies

Frederick W. Holz, Jr. general manager of Reddy Kilowatt Service, died, Sept 3, at his home in New York of a heart attack.

Interior Wins Round in Fight to Halt Vepco's Roanoke Rapids Project

INTERIOR DEPARTMENT finally has won a round in its fight to prevent private development of the Roanoke Rapids hydroelectric project. But the victory looks meager.

Federal Power Commission last week (Sept 2) agreed to reconsider Interior's petition to intervene in Virginia Electric & Power Co's application for a license to build Roanoke Rapids. The Commission rejected the Department's original intervention bid on May 6 and refused to reconsider this decision in June.

Interior's second, and successful, application for reconsideration made no change in the Department's status in the proceeding. FPC merely promised to decide again on the intervention matter at the time it takes final action on Vepco's license application. Interior retains the right to participate in the case informally.

One effect of the reconsideration ruling is to preserve Interior's ability to appeal FPC's final decision on the application. Denied intervention status, the Department needed a legal "grievance" if eventually it wished to appeal to the courts, since only an intervenor ordinarily can appeal a Commisison ruling. The department might claim it was "aggrieved" by its inability to intervene—but it was legally bound to appeal to the courts promptly after the alleged "grievance."

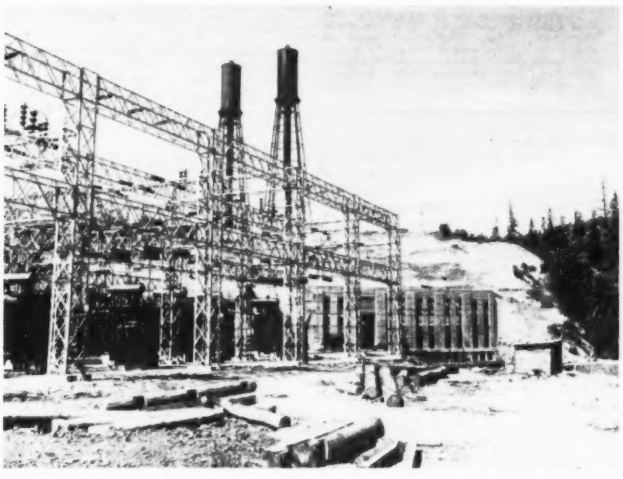
That was why, apparently, the Department continued its efforts to reverse the non-intervention ruling. By postponing final decision on this issue, FPC keeps it legally alive until the Commission rules on the Vepco application. Dismissal of the latter application by FPC, of course, would end the entire proceeding to Interior's satisfaction.

FPC also received principal briefs of all parties to the Roanoke Rapids case last week, including those of its own staff and of Interior. The Commission staff, as it did during the hearings in May and June, insisted that the Vepco project would be "best adapted to a comprehensive plan" for developing the Roanoke River.

Interior's brief maintained that Congress "clearly intended to reserve" for federal developmenet 11 projects in the Roanoke Basin, including Roanoke Rapids. This was based on Congressional "approval" of such a comprehensive plan in the 1944 Flood Control Act. The plan was drawn up by the Army Engineers, who since have started construction of two of the 11 developments, Buggs Island reservoir on the Roanoke and Philpott Reservoir on the Smith River. In the 1944 Act, Interior argued, the word "approved" really meant "authorized."

Not so, the FPC staff asserted, pointing out that such legislation customarily "approves" general plans but "authorizes" only certain projects. Effect of Interior's interpretation would involve "every river system for which Congress has approved, or in the future may approve, a general plan of development, and the Chief of Engineers has submitted general development plans for practically every major river basin in this country."

Reply briefs must be filed with FPC by Sept 23. Chief Examiner Frank A. Hampton will make his recommendations at some time thereafter. At that point the final decision will be up to the Commission itself.



FOUR BANKS of three 8,333-kva single-phase transformers and one spare are already in place at the John Hart development of the British Columbia Power Commission on upper Vancouver Island. Transmission at 138 kv serves the upper island, with an interconnection to British Columbia Electric Railway Co, serving Victoria. Preliminary testing of a third 25,000-kva generator has been completed, and construction of a fourth is under way

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Fight on Interior Funds To Be Resumed in House

Congressional wrangling over funds for Interior Department power programs will be resumed late this month. House leaders are mapping plans to win back for Interior all money slashed from the Department's fiscal 1950 appropriations by the Senate.

Key items at stake are the proposed Delta steam generating plant in California and transmission facilities in that state and in Colorado. The House approved funds for the disputed projects before the Senate acted upon them. A House-Senate conference committee will attempt to iron out these differences shortly after the House ends its recess on Sept 22.

The Senate voted a total of $595 million in Interior appropriations, as compared with the House-approved $536 million.

•

Co-op System Planned

Southern Illinois Electric Cooperative members have approved a plan to join statewide power cooperatives seeking to set up a system linked either to the Tennessee Valley Authority on the south or the Dairyland Power Cooperative on the north. Tentative plans call for building an REA-financed plant in southern Illinois, either at Crab Orchard Lake or Maunie, at an estimated cost of $7 million.

•

Texas Franchise Voted

Denison, Tex., approved a 20-year power franchise for Texas Power & Light Co in a special election recently.

Interior Still Officially Opposes Tacoma Dams

Until new facts can be presented, the Interior Department must support its Fish and Wildlife Service in opposing construction of two hydroelectric dams on the Cowlitz River in southwest Washington by the City of Tacoma, Assistant Secretary C. Girard Davidson declared in Seattle recently. However, he is awaiting data which, Tacoma city authorities assert, will show that the proposed dams would not interfere with the movement of salmon up the river to spawn.

Tacoma has an application pending before the Federal Power Commission for permission to build the dams. The recent state legislature set aside the stream as a fish sanctuary, but Tacoma believes a federal grant in its favor would overrule the state action since the application was made before the state legislature acted.

The two dams, at Mayfield and Mossyrock, would cost an estimated $135 million.

Davidson said he believed more dams on the upper Columbia River and its tributaries to be the only answer to the Pacific Northwest power shortage and that these dams could be built so that the "fish-versus-power" issue would disappear.

SEC RULINGS

General Public Utilities Corp's plan for the divestment of all its common stock interest in Rochester Gas & Electric Corp and for other related transactions has been approved. The divestment was exempted from the requirements of competitive bidding. GPU presently owns all the outstanding 775,914 shares of Rochester common stock, no par value. Rochester will reclassify these shares into 835,000 new shares, and these will then be offered by GPU to its common stockholders for subscription on the basis of one share of Rochester for each ten shares of GPU. GPU will use the bulk of the proceeds from the sale to increase its capital investment in its subsidiary, Associated Electric Co, and the balance to increase its investment in other subsidiaries and to retire its bank loans. Associated will use the additional capital contribution from GPU to increase its investment in its own subsidiaries, Pennsylvania Electric Co, Manila Electric Co, and Escudero Electric Service Co, and to redeem the balance of its outstanding debentures. Associated owns 107,000 shares of GPU common stock and has indicated its intention to dispose of the warrants it will receive as a GPU stockholder for subscription to the Rochester stock. The plan further provides that GPU will contribute to Rochester all of the outstanding 40,000 shares of common stock, which it owns, of Canadea Power Corp. All of the facilities of Canadea are presently leased by Rochester. Rochester indicated that it will sell approximately 110,000 additional shares of common stock prior to 1950 to provide a portion of the funds needed for its construction program. It estimates the cost of this program at approximately $33,000,000. (Release No. 9296).

Niagara Hudson Power Corp's amended plan has been approved. In an opinion issued on Aug 16, SEC indicated that it would approve the plan if modified in certain respects. As previously reported (EW Aug 27, p. 72) the plan provides for the consolidation of Niagara's three major subsidiaries, Buffalo Niagara Electric Corp, Central New York Power Corp, and New York Power & Light Corp, into a single new company, the issuance by that company of Class A and common stocks in exchange for Niagara stocks, and the eventual dissolution of Niagara. United States District Judge James T. Foley has ordered that a hearing be held in Albany, N. Y., on Sept 30 on the amended plan approved by SEC. (Release No. 9295).

MEETINGS

Instrument Society of America
Clinic on Maintenance of Industrial Instruments, Statler Hotel, St. Louis, Mo., September 9-12; Annual Convention, Municipal Auditorium, St. Louis, September 12-16.

Rocky Mountain Electrical League
Fall Convention, Stanley Hotel, Estes Park, Colo., September 11-14.

Missouri Valley Electric Association
Rural Round-Table, President Hotel, Kansas City, Mo., September 14; Sales and Rural Conference, President Hotel, Kansas City, Mo., September 15-16; Accounting Conference, Robidoux Hotel, St. Joseph, Mo., October 20-21.

Municipal Electric Utilities Association of New York State
Annual Conference, Hotel Murida, Long Beach, L. I., New York, September 14-16.

Public Utilities Association of the Virginias
Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., September 16-17.

American Chemical Society
National Meeting, Hotel Traymore, Atlantic City, N. J., September 18-23.

Southeastern Electric Exchange
Engineering and Operating Section, Hotel Roanoke, Roanoke, Va., September 19-20; Accounting Section, Henry Grady Hotel, Atlanta, Ga., September 22-23; Personnel Administration Section, Henry Grady Hotel, Atlanta, Ga., September 23; Sales Conference, Biltmore Hotel, Atlanta, October 26-28.

Illuminating Engineering Society
National Technical Conference, French Lick Springs Hotel, French Lick, Ind., September 19-23.

Pennsylvania Electric Association
Annual Meeting, Benjamin Franklin Hotel, Philadelphia, Pa., September 20-21; Prime Movers Committee, Hotel Edison, Sunbury, Pa., October 6-7; Transmission and Distribution Committee, Fort Ligonier Hotel, Ligonier, Pa., October 20-21; Relay Committee, Americus Hotel, Allentown, Pa., October 13-14; Systems Operation Committee, Split Rock Lodge, Blakeslee, Pa., October 20-21; Electrical Equipment Committee, Hotel Edison, Sunbury, Pa., October 27-28; Communications Committee, Benjamin Franklin Hotel, Philadelphia, Pa., November 3-4.

Edison Electric Institute
Accident Prevention Committee, Robert Treat Hotel, Newark, N. J., September 22-23; Electrical Equipment Committee, Hotel Van Curler, Schenectady, N. Y., October 3-5; Meter and Service Committee, Leland Hotel, Springfield, Ill., October 3-5; Transmission and Distribution Committee, Lord Baltimore Hotel, Baltimore, Md., October 31-November 1; Prime Movers Committee, Sheraton Hotel, Rochester, N. Y., October 10-11.

Wisconsin Utilities Association
Annual Convention, Accounting Section, Bell View Hotel, Lake Delton, Wis., September 22-23; Joint Annual Convention, Electric and Gas Sections, Schroeder Hotel, Milwaukee, November 21-23.

National Electronics Conference
Edgewater Beach Hotel, Chicago, Ill., September 26-28.

American Society of Mechanical Engineers
Fall Meeting, Lawrence Hotel, Erie, Pa., September 27-30; Annual Meeting, Hotel Statler, New York, N. Y., November 27-December 2.

Indiana Electric Association
Annual Convention, French Lick Springs Hotel, French Lick, Ind., September 28-30.

National Television and Electrical Living Show
Second Annual Show, Sponsored by Chicago Electric Association, Chicago Coliseum, October 1-9.

★ **Interstate Power Club of New York**
Fall Meeting, Hotel Martinique, New York, N. Y., October 3.

National Association of Corrosion Engineers
South Central Region, Adolphus Hotel, Dallas, Tex., October 3-4.

Association of Iron and Steel Engineers
Annual Convention (without exposition), William Penn Hotel, Pittsburgh, Pa., October 3-6.

Canadian Electrical Manufacturers Association
Annual Meeting, General Brock Hotel, Niagara Falls, Ont., Canada, October 4-6.

Iowa Utilities Association
Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, October 10-11.

American Society for Testing Materials
First Pacific Area National Meeting, Fairmont Hotel, San Francisco, Calif., October 10-14.

American Standards Association
Annual Meeting, Waldorf-Astoria Hotel, New York, October 11-15.

International Association of Electrical Leagues
Annual Conference, Hotel Cleveland, Cleveland, Ohio, October 12-15.

Electrochemical Society
Fall Congress, La Salle Hotel, Chicago, Ill., October 12-15.

American Institute of Electrical Engineers
Midwest General Meeting, Netherland Plaza Hotel, Cincinnati, Ohio, October 17-21.

American Welding Society
Annual Meeting, Hotel Cleveland, Cleveland, Ohio, October 17-21.

National Safety Council
National Safety Congress and Exposition, Stevens, Congress, Morrison, Sherman Hotels and the Palmer House, Chicago, Ill., October 24-28. Electrical Equipment Section, Stevens Hotel, October 26-27.

National Metal Trades Association
Annual Convention, Palmer House, Chicago, October 26-28.

National Electrical Contractors Association
Annual Convention, Rice Hotel, Houston, Tex., November 8-11.

National Electrical Manufacturers Association
Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., November 14-18.

Refrigeration Equipment Manufacturers Association
All-Industry Refrigeration and Air Conditioning Exposition, Atlantic City Auditorium, Atlantic City, N. J., November 14-18.

★ **New Jersey Utilities Association**
Annual Meeting, Seaview Country Club, Absecon, N. J., November 18-19.

Exposition of Chemical Industries
Grand Central Palace, New York, N. Y., November 28-December 3.

★ Additions this week

Output Turns Upward; Margin Over '48 Widens

The electric output curve moved upward during the week ended September 3, according to figures released by the Edison Electric institute. The amount of electrical energy distributed by the light and power companies of the country totaled 5,543,913,000 kwhr, comparing with 5,523,316,000 kwhr for the preceding week. During the week ended Sept 4, 1948 the amount of electrical energy distributed totaled 5,496,539,000 kwhr, this year's figure representing an increase of 1.4%. The percent change represents a slight widening over preceding week, when a percent increase of +0.8 was recorded.

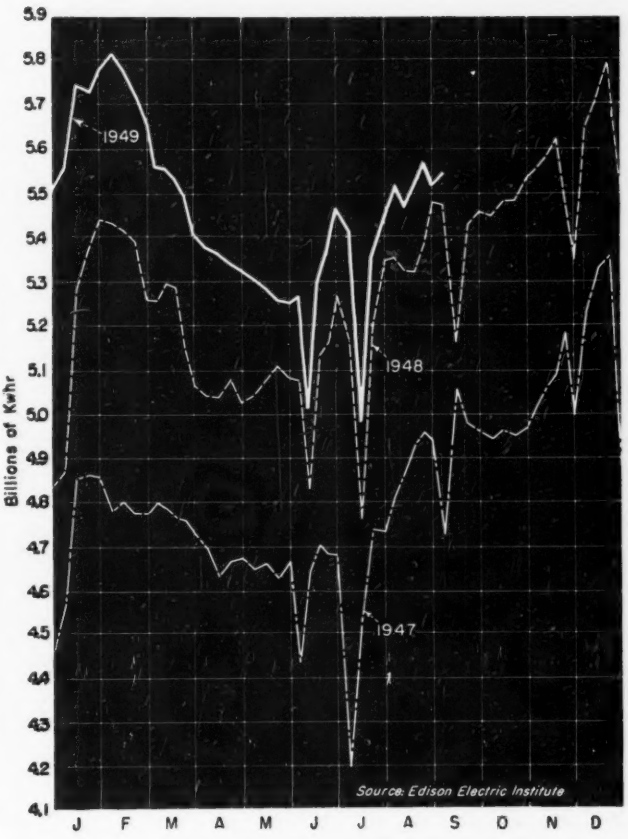
Re-entering the minus column, the New England states reported a percent change of —0.5%. The Mid-Atlantic, Central Industrial and the West Central groups remained in minus column.

Weekly Output, Millions Kwhr

1949	1948	1947
Sept 3 5,544	Sept 4 5,470	Sept 6 4,721
Aug 27 5,523	Aug 28 5,478	Aug 30 4,940
Aug 20 5,579	Aug 21 5,391	Aug 23 4,953
Aug 13 5,530	Aug 14 5,318	Aug 16 4,923
Aug 6 5,466	Aug 7 5,319	Aug 9 4,874
July 30 5,518	July 31 5,352	Aug 2 4,806
July 23 5,462	July 24 5,342	July 26 4,730
July 16 5,342	July 17 5,197	July 19 4,732
July 9 4,982	July 10 4,760	July 12 4,531
July 2 5,410	July 3 5,166	July 5 4,190
June 25 5,466	June 26 5,257	June 28 4,675
June 18 5,373	June 19 5,159	June 21 4,676
June 11 5,300	June 12 5,132	June 14 4,702

Percent Change from Previous Year

	Sept 3	Aug 27	Aug 20
New England	— 0.5	+ 1.8	+ 2.4
Mid-Atlantic	— 1.7	— 4.5	— 1.9
Central Industrial	— 3.7	— 4.6	— 1.1
West Central	— 1.7	— 0.4	+ 6.2
Southeast	+ 2.5	+ 3.6	+ 5.9
South Central	+ 4.9	+ 2.5	+11.3
Rocky Mountain	+13.5	+16.2	+14.7
Pacific Coast	+ 9.3	+ 9.2	+ 8.2
Total United States	+ 1.4	+ 0.8	+ 3.5



Snohomish PUD Takes Over Utility Properties

The Snohomish County Public Utility District, Everett, Wash., began operation Sept 1 of properties in its county formerly owned by Puget Sound Power & Light Co. To finance the purchase the PUD sold a $19.5 million bond issue with an effective interest rate of 3.28%.

Purchase price, as announced by Frank McLaughlin, company president, was about $16.5 million plus accounts receivable. About $6 million of the proceeds from the sale, in the form of U.S. Treasury bonds, was turned over to the trustee under the company's mortgage, "subject to release to the company by the substitution of other property from time to time as needed for construction purposes," McLaughlin said.

Puget Power and the PUD reached an agreement on the sale last June if the proposed overall acquisition of the company's properties by a group of PUD's could not be completed by Oct 31.

A. S. J. Steele, district manager of the Snohomish County operation for the utility, continues as general superintendent of the PUD. A. H. Murray will be in charge of all operations for the PUD, which also operates a water system. The PUD is required to keep Puget Power employees for at least two years while former company employees in the county on pensions will continue to be carried by the company.

The PUD obtains all its power from the Bonneville Power Administration but has plans to construct a hydroelectric installation in the Sultan Basin, which will develop from 80,000 to 100,000 kw.

The Snohomish County sale, the largest Puget Power has yet made in disposal of its properties, enabled the company to retire about $10 million of its first mortgage bonds at 104¼ plus accrued interest.

Electric Energy Output Sets New July Record

Production of energy by electric utilities during July totaled 23,684,340,000 kwhr, the highest July production total of record, the Federal Power Commission has reported. The July total was 1.7% over last year's and 0.3% above the 23,617,424,000 kwhr produced during June, 1949.

Water power plants produced 7,329,785,000 kwhr in July, a 7% increase over July, 1948. As a percent of July's total production, water power output increased from 29.4% last year to 30.9% this year.

Industrial production, including generation by railway and railroad plants, was 4,261,891,000 kwhr in July, a decrease of 2.6% from the same month last year.

Combined utility and industrial production during July was 1% above the same month last year.

WASHINGTON COMMENT

WILLIAM B. WHICHARD

FUTURE FEDERAL power policy for the Missouri Valley, where the Pick-Sloan plan now is evolving into a patchwork of dams and hydroelectric plants, already can be seen with the naked eye. This is in contrast with early development of federal operations in the Tennessee and Columbia Basins, where the government cut its policy teeth in the power business.

The pattern now definitely established for power distribution in the Missouri Basin is of prime concern to electric utilities in the area. But it's of only slightly less importance to other companies, especially those in the Savannah, Arkansas, Roanoke, and other watersheds where federal power development is slated.

Interior Department, which has the responsibility for marketing federal energy in all these areas, knows already what its wants to do with the Missouri Basin power. Recently the Department announced flatly that the first firm energy will go to "preference customers"—federal agencies, other public bodies, co-ops. Firm power output of the initial installations in the Basin is estimated at 300,000 kw. Though these units will not be in operation until 1953-54, Interior now has bids from "preference customers" in the area for more than twice this amount of firm energy.

Electric utility companies of the area also seek some of this energy, more than 245,000 kw. in all. Of course, this presents no problem to Interior's power marketing staff. Federal law—Reclamation Acts and the Flood Control Act of 1944—direct them to sell first to "preference customers." As far as firm power needs, the Missouri Basin companies, in relation to power districts and co-ops, are like the hungry boy watching a friend munch a juicy apple. Asking for at least the core of the apple, he was informed: "There ain't gonna be no core!"

There may, or may not, be a "core" of Missouri Valley secondary energy for utility companies. There may even be some firm energy available for non-preference buyers. It is hard to conceive that public bodies and co-ops will be able to absorb the entire output from Pick-Sloan hydro plants with a total planned capacity of 1.6 million kw.

It's obvious that the amount of federal energy of any category that will go to utility companies of the Basin will depend upon the type of power system built by the government. Interior is planning "backbone" transmission lines—to interconnect the hydro plants and to reach what it calls "major load centers." It also expects to build an undisclosed number of steam generating plants to back up the hydro capacity.

How much of such a federal power system in the area Congress will approve and appropriate for is conjectural at this point. So far, it has been open-handed with funds for Pick-Sloan projects.

At least one power company already is living with this situation, which soon will confront others in the area. It is the Montana-Dakota Utilities Co, which is wheeling federal energy from the Fort Peck Plant for the government. The company also purchases power from this plant, which is to be integrated with other Missouri Basin developments.

Only other alternative for the industry is to put up what has been, thus far, a losing battle against federal power development in the region. The difficulty with that course is that the federal power expansionists have the votes in the 81st Congress. They proved that in the recent Senate scrap over appropriations for the Interior Department.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Testing insulation with high-voltage d-c is not conveniently done in the field but it does offer good means of ascertaining true insulation resistance.

Ionization or corona are the apparent source of the difference between insulation tests at high and low applied voltage.

Microwaves promise capability of adding facsimile and automatic fault location to the functions commonly afforded by carrier.

Analog computers may prove someday to be as useful for study of utility system problems as the network analyzers have proven to be.

One-line diagram planning of stations and substations is the approach which brings out the merits and limitations of any proposed complication and converges on the simplest feasible layout.

Requisition order forms that go so far as to cover getting a few meter bearing balls out of the meter stockroom are superrefined for economical execution. Items less than 50¢ deserve a "basket."

Brackets for arresters and cutouts can replace a crossarm not needed for any other purpose.

Poles fully assembled on the ground with guys, airbreaks and terminal hardware are being set with mobile cranes, even on 66-kv double circuit lines.

Conveyors of truck-loader design ought not to be completely unadaptable to excavation of manholes.

Line gangs don't object to colored movies being taken of their work on poles. In fact they like to see themselves doing a fine job as well as making acknowledgeable slips.

Comparative Costs Of Resuperheating Installations

Survey establishes detailed economic benefits of reheat where fuel costs, condensing water, attitude on flexibility and complexity are not adverse

NEARLY ONE IN FOUR of 64 utilities that answered a query about the economic comparison of conventional and resuperheat cycles for their power plants have arrived at a favorable decision for resuperheat on the basis of their analyses. Many of the others justifiably refrain from adopting the reheat cycles on the grounds of (1) dominance of hydro on their systems and comparatively low steam-plant load factor, (2) insufficiently large units or (3), most persuasive of all, adversely low cost of fuel. Reheat installations admittedly cost more and the better fuel economy is what ultimately pays for the added outlay. That the savings usually give a fine return on the added investment can be seen from the accompanying tabulations and comparisons, only 4 of the 11 leading to an adverse decision.

Range of Attitude

Nineteen companies had not studied the issue at all or at all thoroughly. Four of these plan to make such studies as the time for further capacity approaches. One has an incompleted study. Another utility (a large one) is undecided.

Eight other companies flatly say that fuel costs in their area are so advantageously low that reheat is no more attractive for them than are the higher values of steam pressure and temperature for conventional installations.

Seven additional utilities have given little or no consideration to resuperheat, some because their units are smaller than the 50 or 60-Mw rating that appears to be the lowest break-even capacity, others because hydro availability results in low load-factor for the supplementary steam plants.

Six utilities (of overall capacities from 150 Mw upward) give reasons

TABLE I—Comparison of Performance, Size, Cost and Savings of Reheat and Non-Reheat Designs

Case		A	B	C	D
Size and Design Conditions:					
Unit capacity	(kw)	40,000	50,000	50,000	50,000
Unit capability	(kw)	44,000	65,000	65,000	65,000
Steam press. at suphtr. outlet	(psig)	1300	1300	1500	1500
Steam press. at throttle	(psig)	1250	1250	1450	1450
Steam press. to reheater	(psig)	.....	.....	.....	397
Steam temp. at throttle	(F)	950	950	1000	1000
Steam temp. to reheater	(F)	.....	.....	.....	684
Steam temp. from reheater	(F)	.....	.....	.....	1000
Feedwater temperature	(F)	415	415	448	448
Exhaust pressure	(in., Hg)	1.0	1.0	1.0	1.0
No. closed heaters		5	5	6	6
Steam flow to throttle	(lb/hr)	375,000	540,000	512,000	430,000
Steam flow to reheater	(lb/hr)	.....	.....	.....	359,565
Boiler design steam flow	(lb/hr)	400,000	540,000	512,000	430,000
Boiler design pressure	(psig)	1475	1475	1670	1670
Dimensions:					
TURBINE					
Overall-turb, gen, & exciter	(ft, in.)	55-2	63-2	63-2	65-9
Overall for straight pull	(ft, in.)	67-4	76-7	76-7	79-0
BOILER (estimated)					
Boiler width col.	(ft, in.)	37-0	45-0	43-0	40-0
Boiler depth col. A to B	(ft, in.)	26-6	26-6	26-6	26-6
col. B to C	(ft, in.)	27-6	27-6	27-6	27-6
Overall height	(ft, in.)	106-2	106-2	106-2	106-2
Dollar Costs:					
Turbine (base price plus 5%)		1,020,075	1,255,450	1,297,320	1,412,320
Erection cost		80,000	100,000	100,000	100,000
Total turbine		1,100,075	1,355,450	1,397,320	1,512,320
Boiler		775,000	965,000	970,000	1,026,997
Erection cost @ $3.00 per hr		210,000	240,000	240,000	270,000
Total boiler	$	985,000	1,205,000	1,210,000	1,296,997
Estimated total plant cost	$	5,859,575	7,136,450	7,078,320	7,186,817
Cost increase over No. 1 Unit	$	.....	1,276,875	1,218,745	1,327,242
Annual Generation and Savings:					
Annual generation @ 75% L. F. (initial)	Mkwh	289,000	426,000	426,000	426,000
Operating net plant heat rate	Btu kwhr	10,993	10,938	10,301	9,769
Comparison of designs		.....	(A-D)	(B-D)	(C-D)
Annual fuel savings	tons	.....	33,265	19,158	8,712
Annual fuel savings	$	.....	269,447	155,180	70,567
Capacity gain	kw	.....	21,000	21,000	21,000

TABLE II—Comparison of Estimated Construction Costs (dollars)

Item	A 40–44,000 Kw 1250 Psi 950 F	B 50–65,000 Kw 1250 Psi 950 F	C 50–65,000 Kw 1450 Psi 1000 F	D 50–65,000 Kw 1450 Psi 1000 F 1000 F Reheat
Building substructures	110,000	150,000	140,000	130,000
Building superstructures	775,500	900,000	890,000	870,000
Other structures	27,500	27,500	27,500	27,500
Boiler unit erected	985,000	1,205,000	1,210,000	1,296,997
Draft system	165,000	225,000	215,000	200,000
Feed water system	231,000	300,000	290,000	285,000
Raw coal handling system	38,500	40,000	40,000	38,500
Ash handling system	49,500	60,000	58,000	55,000
Water supply and purification	33,000	40,000	38,000	35,000
Boiler instruments and meters	38,500	38,500	38,500	38,500
Boiler plant piping and insulation	302,500	350,000	340,000	330,000
Turbo-generator unit, erected	1,100,075	1,355,450	1,397,320	1,512,320
Condensing equipment	231,000	320,000	300,000	270,000
Turbine instruments and meters	27,000	27,000	27,000	27,000
Turbine plant piping and insulation	104,500	150,000	140,000	150,000
Station electric equipment	583,000	680,000	675,000	665,000
General plant equipment	71,500	80,000	78,000	75,000
Substation equipment	357,500	425,000	420,000	410,000
Subtotal	5,230,575	6,373,450	6,324,320	6,415,817
Contingencies	183,000	223,000	220,000	225,000
Engineering	223,000	270,000	267,000	273,000
Interest during construction	223,000	270,000	267,000	273,000
Total Cost	5,859,575	7,136,450	7,078,320	7,186,817
Increase in cost over No. 1 Unit-(A)	....	1,276,875	1,218,745	1,327,242
Increase in capacity	....	21,000	21,000	21,000
Cost per kw–maximum capacity	133	110	109	111
Cost per kw for added capacity	....	61	58	63

In conjunction with Table I these two compilations show savings and interest accretions of over $1,000,000 for resuperheat in 20 years. Cost per maximum kw no greater for the resuperheat installation

TABLE III—Estimated Savings over a 20-Year Period of a Reheat Turbine Of 65,000 Kw Capability over Non-Reheat Design

Plan	Capability	Design Conditions
C	65,000	1450 psig, 1000 F, No Reheat, 1.0 in. Hg Exhaust, Six Heaters
D	65,000	1450 psig, 1000 F–1000 F Reheat, 1.0 in. Hg Exhaust, Six Heaters

Year	Annual Load Factor	Annual Fuel Savings	13½% on Difference in Investment ($108,497)	Net Annual Savings	Interest Accretions at 5½%
1951	75	$70,567	$14,647	$55,920	$98,732
1952	75	70,567	14,647	55,920	90,669
1953	69	64,922	14,647	50,275	74,648
1954	65	61,158	14,647	46,511	63,032
1955	61	57,394	14,647	42,747	52,681
1956	57	53,631	14,647	38,984	43,506
1957	53	49,867	14,647	35,220	35,421
1958	49	46,104	14,647	31,457	28,349
1959	46	43,281	14,647	28,634	22,964
1960	43	40,458	14,647	25,811	18,277
1961	40	37,636	14,647	22,989	14,230
1962	37	34,813	14,647	20,166	10,781
1963	34	31,990	14,647	17,343	7,884
1964	32	30,109	14,647	15,462	5,857
1965	29	27,286	14,647	12,639	3,879
1966	27	25,404	14,647	10,757	2,569
1967	24	22,581	14,647	7,934	1,382
1968	22	20,700	14,647	6,053	684
1969	19	17,877	14,647	3,230	178
1970	17	15,995	14,647	1,348	0
Total		$822,340	$292,940	$529,400	$575,723
Total net savings and interest					$1,105,123

for not accepting the reheat philosophy. Two were pressed for capacity and saved time by buying standard units for the conventional superheat cycle; it was essentially a matter of shortened delivery. Two of this group are averse to adopting the single-boiler-per-turbine pattern for security reasons. This made reheat unpropitious for one of them because of the resulting complexity of temperature control and for another because flexibility of operation would be sacrificed. One of these companies expressed the opinion that "the 5% gain due to reheat is only slightly better than a break-even proposition, considering incremental cost, complexity of operation, reduced availability and the present stage of the art."

A utility which rejected reheat on the ground of complexity said they do not favor resuperheating because the cycles "are more complicated, require more investment in equipment and show only a small increase in economy over that which we would get with 1,250-psi 950 F units."

Favorable Attitude

Seven utilities (ranging from under 100 to over 600 Mw in total individual capacity) expresed a favorable or even committent attitude without, however, supplying corroborative or comparative data. Some still have reheat units which were installed in the 1924–1932 wave and will add more of the same type. One large utility is installing two conventional units in a new plant, and the concluding two in that plant are almost sure to be reheat units. Another is so convinced by the reported satisfaction with performance of earlier reheat plants that subsequent units "certainly would be reheat" if a new plant were in process of design.

One fairly small utility is jumping to a unit large enough to warrant the reheat outlay for two reasons—one is to economize on condensing water which is limited and the other to obtain the lesser outlay per kilowatt.

Another sizeable company with appreciable hydro puts the attitude this way:

"Our comparative costs indicated that the boiler, draft system, steam-

water system, condenser system, valves and piping cost enough less so that the differential was sufficient to cover the additional turbine cost. The economy gain was thought to be fully 5% at full load; part-load operation will be minor for many years.."

Even more specific in verbal terms are the following reported justifications for adopting an 1800 psi reheat unit:

1. Expected gain in overall efficiency of 4% to 5%.

2. Relatively high cost of generating station equipment, together with increase in fuel costs, puts a higher value on this increase in efficiency.

3. Improvements in boiler design and controls give assurance of ability to maintain desired steam temperature.

4. A single steam generator containing both the superheat and resuperheat elements with the resultant simplification in piping is an important factor.

5. There is a very small differential in cost between a turbine designed for reheat and one for nonreheat. Also the cost differential is relatively small for increase in pressures from, say, 1200 psig to 1800 psig and increases in temperature up to 1000 F, both tending to favor the reheat cycle.

6. Night-time load is such that the reheat units on the system would always be able to operate at a load in excess of 50% under the most unfavorable conditions.

Favorable Comparison

Four utilities adopted resuperheat for recent units on the basis of analyses which were conveyed in condensed form.

One found a 29.4% return (before taxes) on the difference of $233,000 in cost for an 80-Mw unit (100-Mw capability). The difference was $317,000 until the 540 kw lesser consumption by auxiliaries with reheat is credited as an available increase in send-out capability.

A second utility found it warrantable to adopt a 1250-psig 950/950 F cycle for 80 Mw in preference to 1450 psig 950/950 F or 1450 psig 1000/1000 F because it afforded a slightly higher rate of return due to the lesser cost for piping. All three showed up better than 850 psig 925 F, 1250 psig 950 F, 1450 psig 950 F and 1450 psig 1000 F without reheat even with coal at somewhat less than $9.50 per ton.

The third utility chose reheat for 90 Mw at 1250 psig 950/950 F because the thermal gain of 4.75% means an annual saving of better than $80,000 per year with heat at 33¢ per million Btu and an average annual load factor of 60%. Net additional cost of the reheat plant was approximately 2.5% because the added cost of turbogenerators, boilers and steam piping would be partly offset by lesser cost of condenser equipment, feed-water heating system and boiler feed pumps.

Nine percent better heat rate (1000 Btu kwhr less) for an added outlay of $6.47 per kw was the reason for choosing two 1450 psig 1000 F units to follow an initial pair of 1250 psig 950 F units. The breakdown of unit costs was as follows:

Item	*Cost per Kw, Dollars* More	Less
Turbines	3 08	——
Boilers	2 97	——
Piping	0 62	——
Condensers	——	0 25
Induced draft fans	——	0 08
Feed water heat equipment	——	0 12
Engineering	0 25	——
	6 92	0 45
Net additional cost per kw	6 47	

Items not included are smaller boiler feed pump motors, smaller induced-draft fan motors and adjustable speed drive. An unreduced condenser was deemed wise for summer low-water operation. Coal saving at $8.31 per ton and 55% load factor represented a return of 25.4% on the added investment. High load factor operation in the early years should pay off the investment in five years.

Detailed Proof

Comprehensive data were supplied by a utility starting off a new plant with a 40-Mw unit at 1300 psig and 950 F without reheat but interested in deriving the benefits of reheat for a subsequent unit. Their way of figuring showed an aggregate net fuel saving and interest accretion of $1,105,123 over a 20-year period, with load factor tapering from 75% to 17% on the 50/65 Mw-unit used as a basis along with coal at about $8 per ton. The details are in Tables I, II and III which show also that the incremental capacity of the larger unit could be obtained at an outlay of $63 per kw.

Another utility made a favorable decision based on 1500 psig 1050 F/1000 F and a unit with reheat 15 Mw larger than one without reheat. They found (Table IV) that 60% load factor and fuel at 33.2¢ per million Btu would bring a $615,000 value of capitalized fuel saving against an added outlay of $1,380,000 for the (larger) reheat installation. The favorable decision was based in part on the acquisition of 15,000 additional kw at $92 per kw. The larger unit has approximately the same feedwater and throttle flows and will therefore occupy essentially the same space. The difference in heat rate is 3.54% and the initial annual fuel saving $67,500.

Another decision in favor of reheat was based on a net annual saving of $19,000 per year for an 80 Mw reheat unit working at 1450 psig 1000 F/1000 F and 40% capacity factor with $7 coal. The net increased cost of $164,000 indicated in Table V is to be increased to $180,000 to provide 10% overhead. The

TABLE IV—Comparison of a 125,000-kw, 1500-psi, 1050 F, 1000 F reheat unit with a 110,000-kw unit having the same steam conditions but no reheat (additional costs in thousands of dollars)

Turbine	$225
Generator	70
Boiler	370
Pulverizers	30
Fans and ducts	30
Precipitator	90
Condenser	30
Feedwater system	30
Piping	200
Instruments and control	50
Electrical	150
Structural	100
Engineering and overhead	125
Total additional cost	$1,380

TABLE V—Cost Increments for an 80-, 1450-psi, 1000 F, 1000 F reheat installation (thousands of dollars)

	Less	More
Turbine	.....	$200
Boiler	.....	42
Boiler feed system	$54	.....
Condenser	52	.....
Reheat piping	.....	55
Draft system	7	.....
Piping and valve	15	.....
Miscellaneous	5	.....
	$133	$297
Net	.....	164

TABLE VI—Comparative Cost Data for 40 Mw and 50 Mw Units (dollars)

	40 Mw Standard	50 Mw Reheat
Land	15,000	15,000
Building structure	485,000	490,000
Building superstructure	1,525,000	1,530,000
Other structures	425,000	425,000
Boiler units	1,171,500	1,650,000
Draft equipment	245,000	245,000
Feed water equipment	250,000	250,000
Raw coal handling equipment	120,000	120,000
Pulverized coal equipment	8,500	8,500
Fuel oil equipment	10,000	10,000
Ash handling equipment	100,000	100,000
Water supply and purification system	90,000	90,000
Boiler instruments and controls	65,000	70,000
Boiler plant piping and insulation	320,000	325,000
Turbine generator units	1,345,000	1,805,000
Condensing equipment	305,000	305,000
Turbine instruments and controls	25,000	30,000
Turbine plant piping and insulation	100,000	115,000
Station electrical equipment	440,000	475,000
General plant equipment	60,000	60,000
Substation equipment	275,000	295,000
Contingencies	369,000	420,675
Engineering	442,800	504,810
Interest during construction	295,200	336,540
Total	8,487,000	9,675,525

Resuperheat costs 14% more for 20% more rated capacity but charges per net kwhr are 9% less. Net full cost is reduced 10% by reheat at elevated temperature and pressure

TABLE VII—Comparative Economic Data for 40 Mw Standard Cycle And 50 Mw Reheat Cycle

	Unit	Standard	Reheat
Throttle pressure	psig	1,250	1,450 1,250
Throttle temperature	F	950	1,000 950
Back pressure-condensing	in. Hg	1.0	1.0
Type of main unit		Conventional	Reheat
Power factor	%	80	80
Name plate rating	kw	40,000	50,000
Max capability	kw	50,000	62,500
Service hours per year		7,000	7,000
Steam requirements	lb/hr	438,500	430,000
Boilers required		1	1
Boilers capacity rated	lb/hr	400,000	430,000 400,000
Feed water temperature to boilers	F	438	445 438
Annual gross generation	Mkwh	350	437.5
Auxiliary power requirements	%	5.5	5.5
Annual net generation	Mkwh	330.75	413.44
Coal consumption	net tons	146,800	165,170
Coal cost per net ton	$	7.50	7.50
Heat content of coal as fired	Btu/lb	12,500	12,500
Coal per net kwhr	lb	.887	.80
Coal cost, annual	$	1,101,000	1,238,775
Coal cost per net kwhr	mills	3.33	3.0
Estimated plant cost total	$	8,487,000	9,675,525
Estimated plant cost per kw*	$	170	155
Fixed charges on plant cost at 10%	$	848,700	967,553
Fixed charges per net kwhr	mills	2.56	2.34
Total fuel cost plus fixed charges	$	1,949,700	2,206,328
Fuel cost plus fixed charges per net kwhr	mills	5.89	5.35

* Based on max capability of units

increased efficiency of 5% will save $46,000 a year in coal but the 15% fixed charges on the additional investment amount to $27,000. The resulting net annual gain of $19,000 constitutes a 10.5% return on the added investment for reheat. Any actual higher load factor (more in keeping with recent and current experience) would enhance the saving and the return.

Four utilities of 300 Mw or more studied reheat in considerable detail and found the figures somewhat on the favorable side. However, in three instances, the margin was found so small as not to warrant accepting the somewhat added complexity of the installation.

Favorable Figures, Adverse Decisions

The fourth found that generating costs with reheat would be a half-mill less (see Tables VI and VII); the following factors were deemed more than compensating in the instance which led to the analysis. However, "if we were considering the construction of a new station near our load center, with limited condensing water and average priced coal, we would give a reheat installation very serious consideration." Their argument for the current instance:

1. The reheat cycle could not be tied in with any part of the present plant cycle.

2. It would be necesary to keep the reheat unit at maximum load to obtain economic justification and this the system could not support.

3. The reheat installation calls for more capital dollars.

4. Aim is to add similar boilers, promote interchangeability of boiler room equipment and reduce number of spare parts in stores. Reheat would interfere with this objective.

5. Reheat boilers would complicate employee training because the techniques and operating procedures are quite different.

Small Differential

Table VIII indicates an instance where the estimated costs with and without reheat were so close that the annual saving in coal ($41,000) would bring only 7.12% on the added investment ($576,000) for reheat. The coal cost in this instance is substantially above $5 per ton but this figure is used because the fuel adjustment clause passes any departure to the customer so that it is not available for allocation against fixed charges. The night load is low due to hydro availability. The tabulated values contain no allowance for contingencies or contractor compensation. Decision against resuperheat was based on the small earned return, particularly as it implied full boiler availability and no increase in oper-

ating or maintenance charges for a reheat installation.

"A reheat cycle can hardly be justified unless fuel costs are on the increase" was the assertion of a utility that assumed higher than prevailing costs for coal. The partial data in Table IX shows, however, a very small return for a 160-Mw unit operating full-tilt for 6,875 hr with fuel at 40¢ per million Btu. In this instance the adoption of a higher pressure than 1650 psig was even less advantageous than reheat at that pressure. Two percent on $175 per kilowatt was considered too small to warrant favorable action.

In a third case of small difference it was deemed to be of the order of magnitude of the error in estimating —less than 1% spread in combined annual cost for fuel and fixed charges (Table X). The decision adverse to resuperheat was based on (1) availability, (2) reliability and (3) cost of maintenance.

To quote on these points:

"A resuperheat unit requires a longer time to start than a non-reheat unit. The control gear is complicated. A multiplicity of pipes, valves and controls to and from the turbine for resuperheat would add to station maintenance. Two superheaters and superheat controls would be needed. One of these would be a spray resuperheater which has undesirable features. The gains from resuperheat would be lost during light load operation which may be expected to increase as the unit ages. Steam and fuel might be wasted at times to protect the resuperheater from overheating.

"The non-reheat unit has a single superheater and control and a minimum of high temperature piping and valves. The use of 1050 F presents no serious metallurgical problems. This plant should require less maintenance than a resuperheat unit and should, therefore, be less expensive to operate.

"In comparison with resuperheat units, the 1450 psi 1050 F unit should be simpler to install and operate; with less controls should be more reliable and available; and considering maintenance and possible low load operation, should be more economical in total dollar costs."

TABLE VIII—Estimated Cost of Installing a 60,000 Kw Unit With and Without Reheat (thousands of dollars)

	No Reheat	Reheat
Station yard, dredging, etc	250	250
Building (pump and screenhouse included with condenser system)	2,390	2,390
Machinery foundations	106	101
Boiler equipment (single boiler)	1,257.5	1,578.5
Draft system	358	325
Feedwater system	275.5	296.5
Painting boiler-plant equipment	20	22
Condenser system	804	739
Piping, valves and insulation	690	665
Ash handling	113	113
Coal handling	557	557
Fuel-oil system	8	8
Turbogenerator	1,329	1,639
Electrical work	340	340
Station auxiliary equipment	308	308
Preliminary operation	25	25
Engineering and design	790	760
Job supervision	305	305
Insurance and taxes	220	230
Construction plant	285	285
Workmen's transportation, etc	55	55
Total	10,346	10,922

TABLE IX—Plant Cycle Comparisons for 160 Mw Unit

Case		A	B	C
Steam Conditions	Throttle	2000-1050 F	1650-1000 F	1650-1050 F
	Reheat	550-1000 F	450-1000 F	None
	Exhaust (psia)	1	1	1
Max continuous rating (145 Mw nominal)	Gross Mw	160	160	160
	Net Mw	149,448	149,453	149,433
Heat rate Btu/kwhr 160 Mw load	Gross	8,472	8,659	8,940
	Net	9,072	9,271	9,572
Boiler feed pumps and drives		$236,000	$280,500	$316,500
Heaters (six stages)		316,200	290,100	321,600
Condenser and aux		603,655	631,209	690,041
Boiler and accessories		3,551,950	3,321,300	3,192,700
Turbine-generator		3,445,000	3,310,000	3,175,000
Building		3,678,761	3,678,761	3,678,761
Piping and control		570,333	419,069	340,400
Total		$12,501,899	$11,930,939	$11,715,002
Contingencies, engg and int. (40%)		5,000,759	4,772,375	4,686,001
Cost of variable items		$17,502,658	$16,703,314	$16,401,003
6.25 years' savings		$1,287,000	$772,750	
Increase in cost		1,101,655	302,311	
Net gain		$185,345	$470,439	

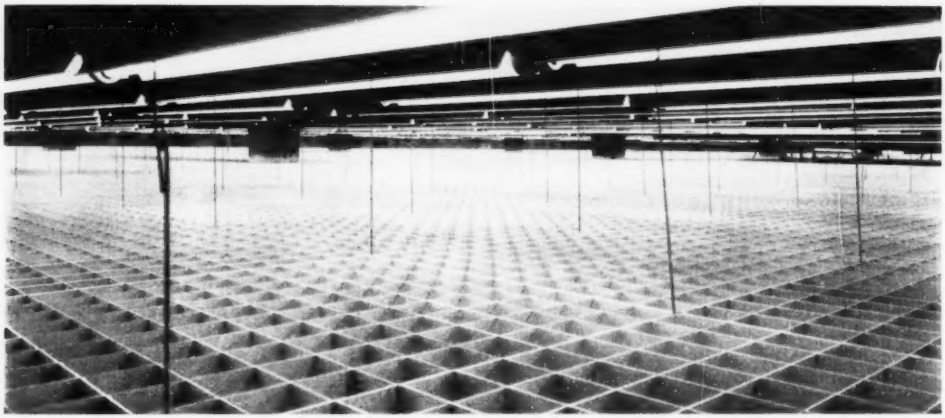
TABLE X—Comparative Data For Heat Balance Equipment of 60 Mw Installation Shows 8.75% Advantage for Reheat

	Resuperheat	Non-Reh
Nominal rating of turbine-generator (kw)	60,000	60,000
Capability of turbine-generator (kw)	75,000	75,000
Steam pressure at throttle (psig)	1,450	1,450
Steam temperature entering turbine (F)	1,000-1,000	1,050
Btu per kwhr net sendout	10,197	10,564
Comparative investment[1] for variable components (dollars per kw)		
Turbine-generator	23.56	22.34
Boiler and accessories	22.83	22.51
Condenser and accessories	5.67	5.93
Boiler feed pumps	3.27	3.51
Piping	11.11	9.85
Foundations for equipment	5.38	5.26
Drafting and design	4.14	4.00
Annual cost for fuel[2] and fixed charges[3]	2,740,925	2,764,909
Difference		+23,984

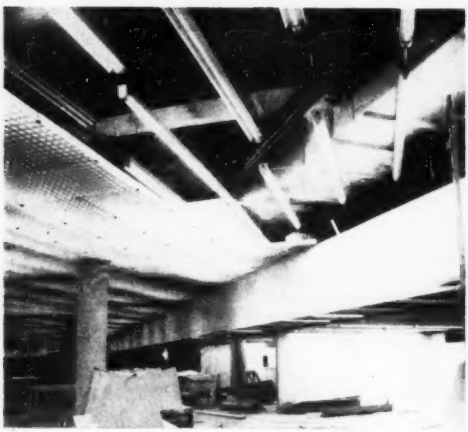
[1] 75,000 kw base
[2] Cost of coal in raw coal bunker—34¢ per million Btu
[3] Annual fixed charges—15%

Louver Ceiling Lighting Used

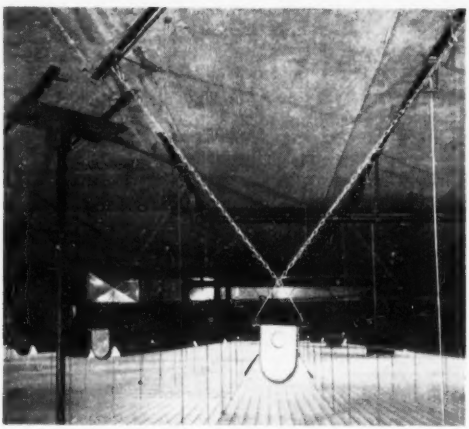
Extreme flexibility of lighting and easy access to fixtures and to mechanical services are provided by new development in louver ceiling. Louver sections are suspended on adjustable hanger rods, eliminating fixed sub-frames



PERSPECTIVE gives illusion of magnificent distance cross top of louver ceiling. Actually, there is only 18 in. between ceiling and lamps



MEZZANINE around sides of store establishes louver ceiling level. Space in mezzanine is used for merchandise stocks and services

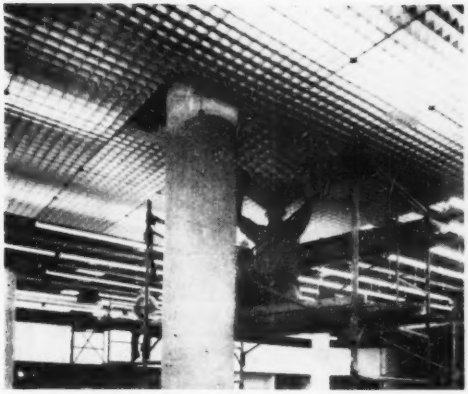


SIMPLE CHAIN and hook suspensions support lamps from channels embedded in concrete floor, making for ease of installation

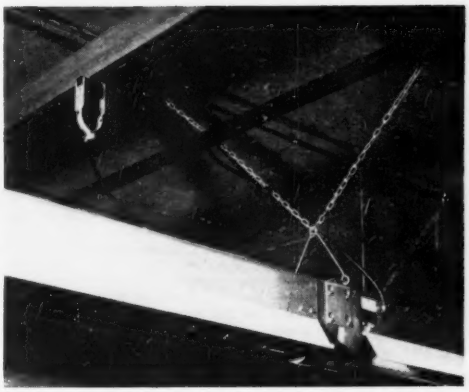
LARGEST INSTALLATION to date of louver ceiling is that in the new Herpolsheimer department store at Grand Rapids, Mich. All three floors, plus basement and sub-basement, totalling 350,000 sq ft, are lighted in this fashion. Feature of the store is the entire absence of fixed interior walls, their places taken by movable partitions that can be moved around like stage scenery as changes may be made in the layout and arrangement of departments. This flexibility demanded a lighting scheme easily adaptable to changed illumination requirements.

The answer was found in what has been named the "Flexi-Module" system, composed of various electrical lighting and architectural units designed by architect George Ely,

Throughout Large Department Store

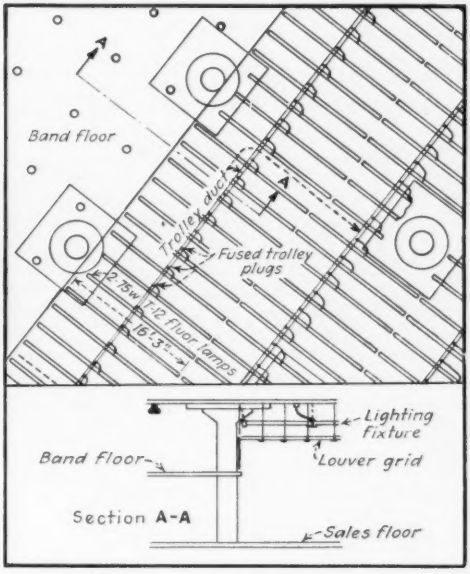


LOUVER PANELS, 32-in. square, rest on small star-shaped castings on the ends of suspension rods. Panels are easily removable



EACH FIXTURE contains two T 12, 75-w lamps, end to end, is 16 ft long and is supplied through fused connection to trolley bus

QUALITY of illumination, averaging 75 ft-c, is apparent in this area, typical of entire store. "Warmtone" lamps bring out color and texture of merchandise, thereby increasing customer appeal



TROLLEY BUSES, spaced 16 ft apart, run normal to lines of lighting fixtures, making it possible for fixtures to be massed or dispersed as necessary to create the desired lighting efect

working in cooperation with engineers of Sylvania Electric Products, Inc. Central element in the system is the ceiling itself. This is composed of aluminum louver panels 32 in. square and with 3-in. cells. Panels are supported at the four corners by suspension rods with leveling devices so that necessary small adjustments in heights of the panels can be made from below.

The lighting fixtures are hung 18 in. above the ceiling. Each fixture contains two T-12, 75-w "warmtone" lamps end to end. Normal to the lines of lamps and fixed to the concrete slab above, are rows of trolley bus from which fused lamp connections are made. Thus as may be necessary for the lighting requirement of any sales area greater or less illumination may be provided by massing of dispersing fixtures. At even spacing of fixtures an average intensity of 75 ft-c is obtained. A total of 6,920 lamps and 3,585 fixtures were installed.

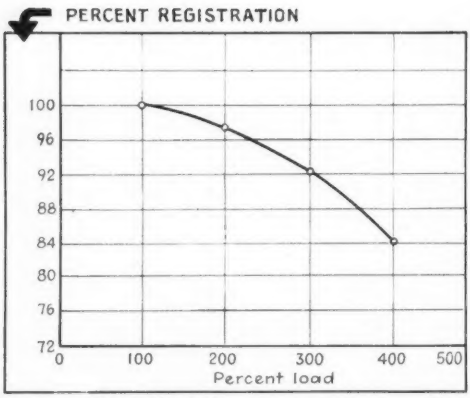


FIG 1—TYPICAL OVERLOAD and accuracy curve of a watthour meter in the 1914–1926 group

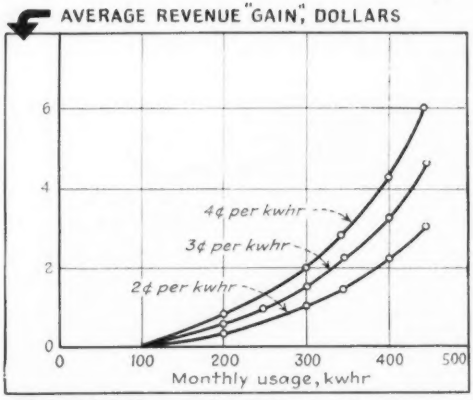


FIG 2—ANNUAL revenue "gain" dollars for kwhr used per month (from ELECTRICAL WORLD, July 22, 1944)

Watthour Meter Obsolescence

Author considers 2-w, 5-amp, 115-v meter obsolescence situation today and arrives at conclusions based on the number of old meters in use and their cost of modernization

A. J. **KEEN**, Superintendent, Meter Dept, Potomac Edison Co, Hagerstown, Md.

A STUDY OF OBSOLESCENCE of domestic-use watthour meters recently completed, and reported before the Meter Committee of the Pennsylvania Electric Association, leads to these nine conclusions:

1. Meters built prior to 1914 should be removed from service and junked.

2. Any "old" (1914–1926) meter measuring over 250 kwhr per month on domestic use should be replaced.

3. Replace any "old" meter due for test measuring over 200 kwhr per month domestic use (175 kwhr rural) rather than test in place.

Note: if 2¢ electricity is used, add 25 kwhr. If 4¢ electricity is used, subtract 25 kwhr.

4. For "old" meters spend no money on repairs unless unusual local conditions make it desirable.

5. Use "old" meters for replacement in towns and urban areas where kwhr use does not exceed 125–150 kwhr per month.

6. Use new (1927 and later) or modernized meters exclusively on new or replacement rural installations.

7. New meters should not be removed from light load customers for the purpose of using an "old" meter unless unusual local conditions and economies permit.

8. Shop testing of meters appears ideal for placing and replacing modern and old meters according to their use.

9. While this discussion has been confined principally to the 2-w, 5-amp meter, the principles may be applied to the 3-w, 15-amp meter as well. However, due to the very small percentage of "old" 3-w meters, obsolescence does not appear to be a problem at this time. Concerning repairs for "old" 3-w meters, different utilities will have different policies depending on local conditions but, generally speaking, it is felt that major repairs cannot be made economically on an "old" 3-w meter unless local conditions permit.

The study leading to these conclusions began with the examination of the obsolescence of 2-w, 5-amp, 115-v watthour meters manufactured during the period of 1914–1926 inclusive.

Fig 1 is a typical curve for one of the so-called "old" meters showing the relationship between percent registration and percent load. A look at this curve raises the question of whether or not load growth is making old meters obsolete faster than we think. It also makes our study appear simple. Apply "old" meters to the low-use customer loads and "modern" meters to the high-use customer loads. If any old meters remain unused, this is the major step toward a retirement program.

But where is the point which divides the low-use customer from the high-use customer? The only practical gage between high use and low use is kwhr, even though load factor and kw demand may vary considerably with different customers.

Assume the annual charges on a new meter is $1.20. If we can find how much revenue is lost due to

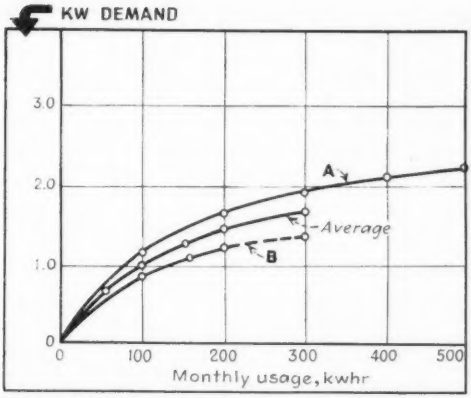


FIG 3—DEMAND in kw for kwhr used. The "average" curve is based on data in curve A (15 min intervals) from ELEC WLD, July 22, '44, and in curve B (30 min intervals) *Elec Lt & Pwr*, July '40

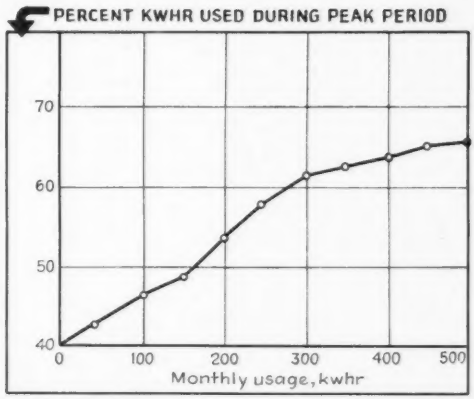


FIG 4—PERCENT kwhr per month used during peak periods in residential service in relation to monthly kwhr-usage (ELECTRICAL WORLD, Aug. 24, 1940, p. 51)

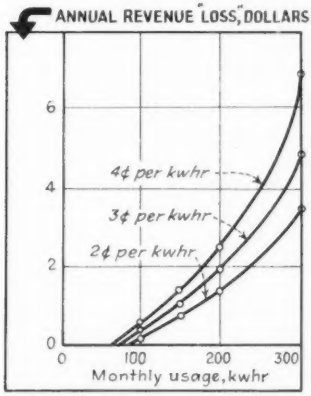


FIG 5—ANNUAL revenue "loss" dollars for kwhr used per month

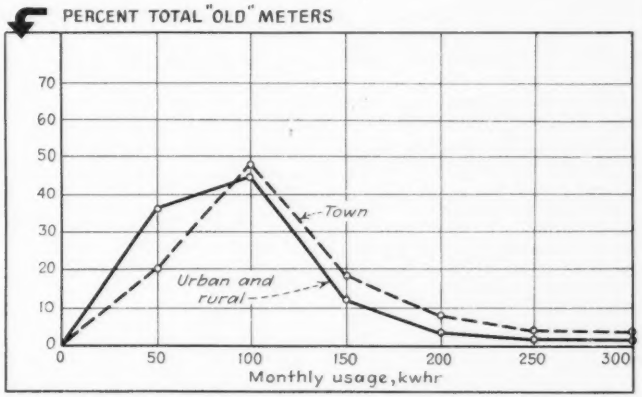


FIG 6—PERCENT of total "old" watthour meters for monthly kwhr usage, based on data from two areas

under registration by an "old" meter at different kwhr consumed, we can locate the point where the loss equals the fixed charges on a new meter.

If this loss is to be calculated, the percent of the total kwhr used during the peak period, and the relation between kw demand and total kwhr used is information that must be available with reasonable accuracy.

In late 1940 a survey on a national scale was started to determine the difference between the registration of modern meters and the older types of meters. While this survey was never completed due to the beginning of World War II, valuable data was accumulated. See ELECTRICAL WORLD, July 22, 1944, pp 75–77 and Fig 2.

Other studies have been made in connection with this subject involving the study of typical customer load curves so that the percent registration curve (Fig 1) may be applied.

Information available shows certain relationships in Fig 3 and 4.

Using Fig 1, 3 and 4 and 3¢ per kwhr, three examples are given for calculating annual dollar loss.

Example 1:

Kw demand for 100 kwhr per month = 1.0 kw.

A demand of 1.0 kw is a load of

$$\frac{1000 \times 100 = 174\%}{115 \times 5}$$

At this point the meter is 2% slow.

Kwhr lost per year =

$$0.46 \times 100 \times 0.02 \times 12 = 11.0$$

Dollars lost per year =

$$11.0 \times 0.03 = \$0.33$$

Example 2:

Kw demand for 200 kwhr per month = 1.45.

A demand of 1.45 is a load of 252%.

At this point the meter is 5% slow.

Dollars lost per year =

$$0.54 \times 200 \times 0.05 \times 12 \times 0.03 = \$1.95$$

Example 3:

Kw demand for 300 kwhr per month = 1.7.

A demand of 1.7 is a load of 295%.

TABLE I

Percentage of "Old" Watthour Meters in Two Areas

(2-w, 5-amp, 115-v meters manufactured in 1914-1926)

Item	Rural and Urban Area, includes one town of approx 12,000 population		Town, approx 45,000 population (1,016 meters used as a sample)	
Meters	Quantity	Percent	Quantity	Percent
Total installed	3,557	100	1,016	100
"Old" type	2,009	56.5	671	66.0
"Modern"	1,548	43.5	345	34.0
"Old" meters usage				
0- 49 kwhr	736	36.6	135	20.0
50- 99	925	46.0	319	47.5
100-149	245	12.2	125	18.7
150-199	66	3.3	54	8.1
200-249	20	1.0	18	2.7
250-299	8	0.4	8	1.2
300 & over	9	0.5	12	1.8
Total	2,009	100.0	671	100.0

At this point the meter is 7.7% slow.

Dollars lost per year = $0.61 \times 300 \times 0.077 \times 12 \times 0.03 = \$5.08$

Curves in Fig 5 show revenue loss based on calculations in the foregoing examples.

What does this mean to us? Information in Table I has been accumulated for two small areas, and this should be representative of many areas throughout our territory. The data has been arranged graphically in Fig 6.

In starting this study, one of the objectives was to find X number of kwhr whereby the loss in dollars due to under registration of an "old" meter equals the fixed charges on a new meter. This appears to be about 220 kwhr per month for the average customer with 3¢ electricity. However, due to differences in studies and data available, this could be as high as 280 kwhr and as low as 165 kwhr.

It should also be pointed out that some weight must be given to the advantages of new meters not heretofore considered. For instance, the use of new meters is advantageous where lightning surges are prevalent. Perhaps this one particular advantage could be evaluated whereby use would be made of a figure of X kwhr for urban and something less the X kwhr for rural.

So far, this topic of meter obsolescence has been handled from a supply and demand standpoint and naturally this will vary with different companies. Companies who have more "old" meters than they need, generally speaking, will not be concerned with repairs for these meters. However, some companies will want to make repairs depending on local conditions. For example, one company can recondition and test an old meter in 33 min. Another company may want to apply aluminum protectors on old meters. Some other company may have an excess of modern 2-w meters due to heavy range installations, causing the removal of 2-w services and meters.

As far as the 3-w meter is concerned, some day we may have a similar experience as with the 2-w meters. However, most of our 3-w meters are modern and justify repairs when needed. The comparatively few "old" 3-w meters do not represent a serious problem now. A tabulation of the 3-w meters in the same rural and urban area mentioned in Table I showed only 52 "old" 3-w meters in a total of 5,472 or about 1%, compared with 56.5% "old" 2-w meters.

Cost of repairs of course determines whether to repair or scrap. Some costs of repair parts are listed in Table II. Cost of labor for making repairs will vary considerably with local conditions and while cost of labor for repair work is generally considered high, the cost of some repair parts for "old" meters has reached the prohibitive point.

TABLE II

List Price of Old and New Meter Parts

(Prices subject to discount)

Meter Group	1914-1926		1948	
Kind of Meter	2-w 5-amp	3-w 15-amp	2-w 5-amp	3-w 15-amp
	Dollars			
Meter Element	6.95	11.00	4.60	6.00
Glass Cover	1.85	1.85	1.60	1.60
Permanent Magnet	2.80	2.80	2.40	2.40
Disk	0.90	0.90	0.80	0.80

Low-Brightness Ceiling Lighting

Fluorescent Lighting Association

EFFECT of a luminous ceiling, providing shadow-less light on work surfaces, is accomplished in the drafting room of the International Engineering Co, Inc, Denver, Col., by low-brightness cold-cathode tubes. Average intensity on the drafting desks is 55-60 ft-c and on the center reference tables 40-50. Set on 15-in. centers, the tubes are standard 8-ft, 25-mm, 4,500-deg white. The large bay, 21 x 100 ft, containing 12 cross-wise sections each holding 10 lamps, is served by two transformers, one at each end of the room and connected to six sections. Ceiling height is 11 ft. In the complete installation, main and side bays, are 196 lamps

HOMES for 3,500 customers, such as these, were without electricity for 15 min. during pre-arranged outage. Particular residential area was selected because of high concentration of household appliances

Please indicate by a check mark whether you have any of the following electric motor driven equipment in your home:

Electric Refrigerator.....☐
Electric Refrigerator with deep freeze compartment.....☐
Separate electric deep freeze....☐
Oil Furnace.....☐
Motor-driven furnace stoker.....☐
Motor-driven furnace fan.....☐
Coal furnace draft fan.....☐
Water circulating pump.....☐
Other (Please Specify).....☐

Do you have an electric range?

Yes☐ No☐

Before or during the 15 minute outage on Wednesday, December 29th, at 6:15 P.M., did you take any special action to disconnect any electric equipment or lights because you knew there was to be a test?

Yes☐ No.☐

If answer is Yes, please check the items turned off or disconnected:

Lights.....☐
Electric range.....☐
Refrigerator.....☐
Other.....☐

63% OF CUSTOMERS checked and returned this reply card listing their appliances

Planned Public Relations Pays

GEORGE W. PRING
Publicity Director, Central New York Power Corp, Syracuse, N. Y.

IF THERE EVER was a laboratory test case to prove that planned public relations pay off, it was at Syracuse, New York, when the Central New York Power Corp staged a planned interruption of electric service to 3,500 customers in a heavily-loaded residential area to prove a new relay. Moreover, the 15-min outage was purposely staged at 6:15 o'clock in the evening on one of the peak days of the year, the Wednesday after Christmas.

Almost any utility man would expect that the immediate results of such an interruption would be hundreds of angry telephone calls and a decidedly adverse reaction by press and radio. Actually, because of a planned public relations program, the company received only four calls, none of which was a complaint. The press and radio thought the company had done a good job!

Even more significant was the reaction a few days later when the company asked all these customers to go to the trouble of returning a post card so that engineers would have reference data for their study of the outage. Company engineers were hopeful that as many as 10% of the cards might be returned. That many cards came back in three days, and the final return was over 2,000, a response of 63%.

What had started out to be a highly technical test of a new type of power control equipment also proved to be another kind of project—a large-scale test of what can happen when customers are taken into the confidence of the company in a situation that affects their service.

The technical aspects of the test are discussed in the following article. Briefly, engineers of the Central New York Power Corp and the General Electric Co had developed a new type of relay which they believed would solve a major problem of the electric industry—the quick and sure restoration of service on feeders serving a network with high concentration of motor-operated appliances. On paper and in the laboratory the idea seemed feasible, but the only possible way

of knowing whether it would work in the field was a test interruption of service under actual peak operating conditions. After long and careful consideration, the management of Central New York Power agreed to make this test, because of its potential benefits to its own customers and to the entire electric industry.

A section of the City of Syracuse, served by a 4,000-v feeder, was selected for the test, because homes in that area had a high concentration of motor-driven appliances, and because no hospitals, institutions, or industries were in this particular section.

John L. Haley, president of Central New York Power Corp, decided that from the very start the people living in this area and the city at large should be fully informed of the test, its purpose and results. The first step taken was a letter from Mr. Haley to every customer in the test-area, as follows:

Dear Customer:

"This letter is to advise you that electric service in your neighborhood will be temporarily suspended on

Wednesday Evening, December 29th
6:15 to 6:30 o'clock

The purpose of this interruption is to test a new type of power protection equipment that we believe will benefit you and all users of electric service.

We realize that any interruption to your electric service is unusual. On the attached page, there is a complete explanation of the test, and why it is to be conducted in the particular area of Syracuse at the time selected.

The results of this test will be made available to all electric companies and equipment manufacturers throughout the country. Because all consumers of electric power will ultimately benefit from the facts obtained in this project, your consideration and understanding will be greatly appreciated."

With each letter was a single sheet inclosure, headed "The Test Will Benefit All Users of Electric Service." This was a simple, non-technical description of the reason for the test and how it would be conducted. Phrased in lay language, it was designed to make each customer feel that he would share in a significant project that would benefit himself and many others.

Copies of the letters and inclosure, with news releases, were supplied to the two Syracuse daily papers and the news bureau of the five radio stations. A representative of the company visited each of these to answer any questions.

Meanwhile, other company men outlined the project to the mayor, city engineer, and the chiefs of the police and fire departments. Maps were prepared showing exactly the various residential blocks that would be affected, and copies were supplied to police and firemen.

On the morning of the test, all company personnel who were to take part directly, including particularly customer contact employees, attended a meeting. The chief engineer, relay engineer and others explained the proposed test in detail. Possible contingencies were discussed and procedure outlined.

No one in the company could be certain what the public reaction would be, or how many customers had understood or accepted the letters and publicity. Therefore, steps were taken to handle the situation as if 3,500 customers were without service because of a storm or other unplanned interruption. Preparation for a possible flood of "no-light" calls were made by assigning four additional customer-service telephone operators to the board.

Customer Reaction

The test itself proceeded exactly on schedule and without incident. Customer and public reaction developed as follows:

Four calls came in from the test area during the interruption (one for each extra operator on duty), two of these were from people who said they did not know about the test. Within ten minutes after the test, there were four additional calls from the area on individual house service troubles that were not related to the operation.

It was clearly evident that the 3,500 customers and their families had read and heard the advance publicity, and understood what was going on. The next step taken by the company revealed how these customers felt about it.

As soon as the results of the test were known, Mr. Haley sent each customer the following "thank you" letter, with a return post card listing various motor-driven household appliances:

Dear Customer:

This letter is to thank you for your cooperation and consideration in the test interruption of service that took place on Wednesday evening, December 29th.

I am glad to tell you that the new method of power control worked successfully. The required equipment is now being manufactured and we will install it as soon as possible wherever it can be used effectively.

I would like to ask one more favor. It would help our engineers a great deal if they could have the information requested on the inclosed card. You need not sign your name or address, simply check off the few items listed and drop the card in the mail.

Our engineers, technicians, telephone operators and all others who took part in the test appreciated your consideration and interest in the project. Please accept my personal thanks, and my sincere good wishes for this New Year.

Note: The reason we are requesting the information on the card is this. The new power control equipment is designed to permit rapid restoration of service after an interruption in areas where there are large motor loads. *Any information that will give us a more exact estimate of the number of electrical motors affected by the test would be helpful, particularly in checking our own calculations.*

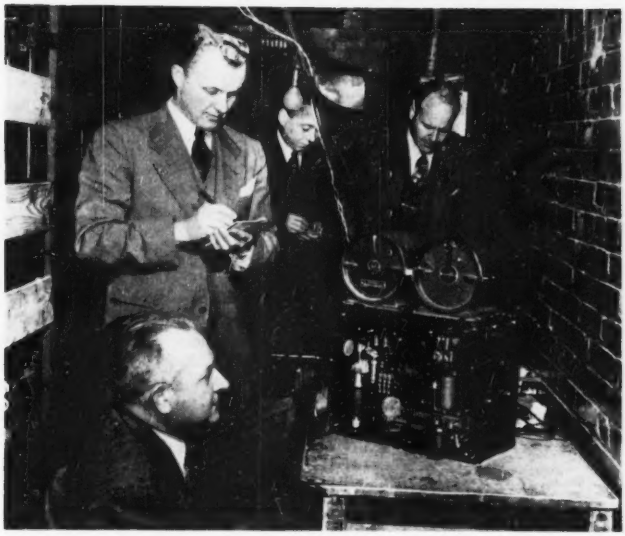
On the card, customers were asked to check appliances in their homes, and also to check any they had turned off during the test.

When this letter drew an unprecedented return of 63% the company had a clear demonstration of the real interest that customers were taking in the project.

Interest in Test Results

There were other indications. Many customers called to find out how the test had come out; and others, technically minded, offered suggestions. The newspapers and radio commentators treated the project as a progressive step taken by the company to improve service to its customers and benefit the industry. Employees living in the test area reported that their neighbors were keenly interested in the whole undertaking and universally pleased with the method taken by the company to stage the test.

Note: The following article covers the technical aspects of the test.



AUTHORS AND OBSERVER viewing oscillograph arranged for recording the pick-up currents after the staged outage on the feeder serving 3,500 customers

New Relay Assures Feeder Resumption after Outage

Part 1

Comprehensive staged tests on 3,500-customer feeders at peak hour reveal pick-up consequences from loss of diversity of automatically-controlled motors

L. J. AUDLIN and M. H. PRATT
Central New York Power Corp

A. J. McCONNELL
General Electric Co

A RELAY different from those normally used for phase-overcurrent protection has been subjected analytically, and by actual field test on a heavily loaded urban feeder, to pick-up conditions which are considered to be both typical and severe. It appears to be well suited to the purpose. In the case of many feeders, the application of this relay should solve the problem of immediate and full feeder pickup after outages of any length, without either sacrifice of excellent fault-protection practices or changes in feeder design, layouts or operation.

In other cases, this relay may be applied in conjunction with a minor amount of coordinated branch fusing to accomplish the desired result. It does appear likely that coordinated main sectionalizing would never be necessary where this relay is applied. This relay has ample leeway to take care successfully of a wide range of automatically controlled motor load, extending considerably beyond the proportions of such load encountered on many feeders today.

The proposed relay will also coordinate very much better with line and equipment protection fuses used on distribution circuits than will any of the commonly used phase relays. This is because its characteristic curve has almost exactly the same shape as a fuse curve throughout its full length. This advantage is not only related to its ability to solve the basic problem of feeder pickup, but also stands as a very real one in its own right, as it will frequently permit a definitely better degree of fault protection.

The relay proposed might be termed an "extremely" inverse type. It has been previously applied quite generally as a ground relay designated as Type ICC11A. The designation of this relay as built and supplied for use as a phase-overcurrent relay is Type ICC29. Very shortly a relay having these characteristics and designated as IAC77 will be available.

Loss of Diversity

During a period of outage, the load demand of most present-day distribution feeders will be automatically and often greatly increased above the load immediately preceding the outage. Neglecting the first few cycles, this effect is largely caused by a combination of loss of the normal diversity of motors automatically started and stopped by pressure, temperature, or other automatic control devices, and the fact that all motors connected ready to start will also impose their starting demands on the feeder.

If the demand on a feeder at any given instant within a relatively short time after service restoral is expressed as a percentage of the demand just before the outage, then this percentage for any given feeder will be mainly a function of:

1. The amount of automatically controlled motor load served by the

Adapted from paper at recent meeting of EEI Transmission and Distribution Committee.

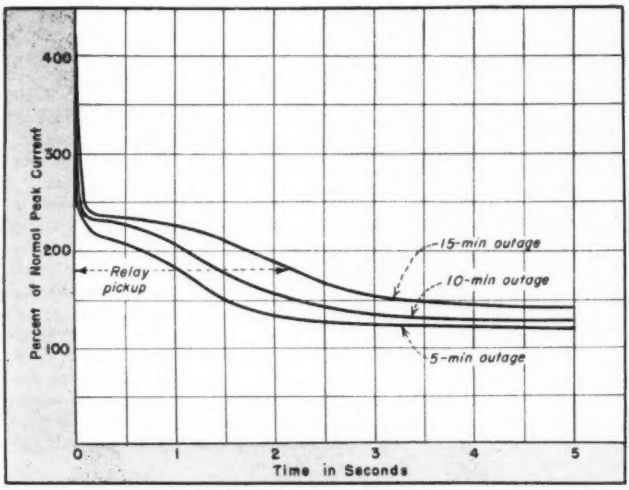


FIG 1—TIME-CURRENT CURVES for pick-ups of feeder load for first 5 seconds after 5, 10 and 15-minute duration of prearranged interruption

feeder relative to the amount of other load—lighting, non-automatic motors, other appliances, etc.

2. The operating cycle of the automatically controlled motors.

3. The length of the outage.

Saturated Outage Time

With any given feeder, there will be a certain length of outage which will result in maximum increase of feeder demand. The automatically controlled motors and devices served by the feeder will be connected by their controls in their starting position if the outage is sufficiently long. Such a length of outage will be referred to in this paper as the "saturated" outage time. Any further length of outage than this will cause no further increase in demand on restoral of service although it may increase the time before fully normal conditions are re-established. The saturated outage time depends largely upon the normal operating cycles of the automatically controlled motors. For example, where a majority of the automatically controlled motors have a normal cycle (including one "on" and one "off" operating period) of 20 min., the saturated outage time can normally be expected to be close to 20 min. Outages of shorter duration will approach saturated demand effects quite rapidly.

Four Time Phases

A study of data and analyses already available shows that there will be four separate time phases of the increased restoral inrush or pick-up demand on any feeder after an outage. Each phase will be of progressively lesser average magnitude. The test reported in this paper further confirms this conclusion. These four time phases of pick-up demand in order are:

The first—Starts at the instant of restoral and lasts for only a cycle or two. It includes inrush currents to cold lamp filaments and to distribution transformers, and may be of lesser magnitude than has sometimes been suggested (Fig 1).

The second—Lasts for approximately 1 sec and covers the period where most of the effect is due to motor starting currents superimposed on the other base feeder load. There is some evidence that during this phase the demand curve tends to change its steep downward slope to a more flat slope and even in some cases to turn upward to some degree as saturated outage times are approached (Fig 5, Curve B of ensuing installment).

The third—Extends to about 15 sec after restoral, during which period the demand will rapidly decrease from the starting phase level as the motors come up to running condition (Fig 2).

The fourth—Runs from about 15 sec after restoral until the normal pre-outage motor-diversity conditions are re-established on the feeder. The first five minutes or so of this phase will be approximately a constant level demand, after which the demand will begin to fall off towards normal, and there will then be a highly damped cyclical variation of much smaller amplitude, possibly both above and below normal demand, dying away over an indefinite period of perhaps an hour or more (Fig 2). This phase is of no practical importance in restoring a feeder, providing the relay pick-up is greater than the maximum current during this period.

Tripping by Pick-up Inrush

Clearly, if the station breaker relays on any distribution feeder close their trip contacts under the pick-up inrush, the feeder will be immediately disconnected again. The service restoral will be unsuccessful, and the service outage will be extended because of this until one of these things is done:

1. The relays are made non-automatic for the period necessary for the load to reach a value which will not affect them.

2. The relays are set up to a value sufficiently high to prevent the contacts closing on the integrated effect of the inrush.

3. The inrush requirements have been reduced by some means such as feeder sectionalizing.

While it is quite possible to arrange that additional automatic control equipment will automatically accomplish procedure **1**, this is not only generally undesirable on the grounds of the complication of any added auxiliary control devices, but also basically a procedure (whether handled manually or automatically)

open to considerable question on protection grounds.

Procedure **2** is not only satisfactory, but also is by all means the only proper solution, provided that proper protection against basic minimum faults is retained. Unfortunately, with the relays in most general use today, it is more and more frequently found impossible to set these relays high enough to hold in on inrush without destroying, or at least seriously interfering with, their basic purpose of protection against faults.

If a feeder will not restore after an outage, and relay settings have reached the limit for proper protection, then an extended outage will result. This lasts until the feeder is sectionalized in the field and restored piecemeal. It is always questionable practice to cut corners on this time-consuming procedure by simply assuming that there is no trouble remaining in the feeder.

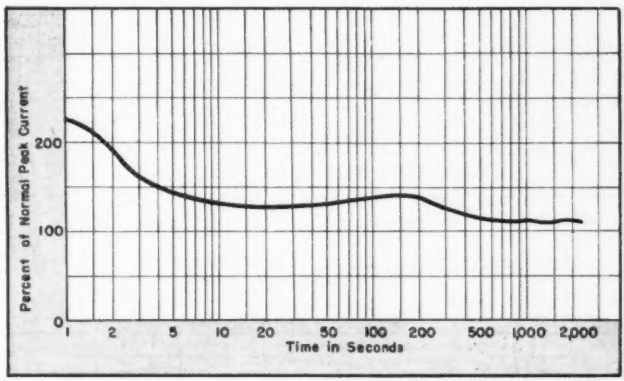


FIG 2—PICK-UP CURRENT after initial inrush goes through cyclic "settle-down" as automatic loads recover their normal diversity

Preferable Solutions

The above makes it evident that different solutions, if available, would stand in the following order of operating and economic desirability, and general preference.

First—A relay for phase-overcurrent protection which could simply replace presently-used types, and which would permit settings to avoid tripping on inrush currents of feeders carrying total loadings of the same order of magnitude as have been used generally in the past. Such a relay must still give, with such settings, proper and adequate fault protection, without any special new requirements in basic feeder design or arrangement.

Second—Some method of sectionalizing a feeder by automatic pole-top or line-sectionalizing switches, so designed and controlled that upon restoral of service at the station, the feeder would be automatically picked up sequentially by these devices, in two or more sections as dictated by the requirements of the individual case.

Third—Revision downward of past standards of the normal load permissible on a feeder. This solution amounts to decreasing the effectiveness of use of materials and therefore would be highly wasteful, inefficient and costly.

The various analyses, investigations and papers presented up to now

Comprehensive appliance data was supplied by a large fraction of customers on the feeder

Cards were tabulated in groups of 100 as received Group	Total meters	Standard electric refrigerators	Electric refrigerators with deep freeze compartments	Electric refrigerators Total	Seperate electric deep freeze units	Oil furnaces	Motor-driven furnace stokers	Furnace fans	Water pumps	Other automatic on-off motors	Electric ranges	Number who turned off (because of test) Motors	Lights
1	100	94	4	98	7	14	1	18	1	0	3	1	1
2	100	89	10	99	18	16	3	21	4	0	5	5	1
3	100	92	4	96	7	12	2	24	0	0	4	2	4
4	100	87	10	97	5	5	2	16	0	0	3	2	4
5	100	92	5	97	6	10	3	25	0	0	3	3	4
6	100	81	13	94	7	12	3	21	0	0	3	3	3
7	100	92	2	94	9	11	2	25	1	0	6	1	2
8	100	106	4	110	13	12	3	20	2	0	5	2	5
9	100	87	5	92	8	8	6	17	0	0	2	1	2
10	100	91	5	96	12	12	3	26	2	1 Air cond.	5	4	2
11	100	87	9	96	3	13	1	20	2	0	2	1	2
12	100	88	6	94	14	9	4	20	0	0	4	3	2
13	100	95	5	100	8	9	2	23	0	3 Compr.	5	1	4
14	100	93	6	99	11	14	1	24	2	3 Compr.	2	2	1
15	100	89	11	93	10	6	5	17	0	0	6	1	1
16	100	86	14	100	7	11	2	16	0	0	2	6	4
17	100	98	6	104	6	7	2	21	2	0	2	3	1
18	100	88	4	92	8	11	1	18	2	0	0	5	4
19	100	90	9	99	7	8	5	25	3	0	1	5	5
20	100	97	8	105	6	12	1	16	1	0	3	2	1
	2,000	1,815	140	1,955	172	212	52	415	22	7	66	53	53
Percent of total	.....	90.8	7	97.8	8.6	10.6	2.6	20.8	1.1	0.4	3.3	2.6	2.6
Pre-Test Estimates (Percent)	.....			95	10	10	10	15	0	0	.....	.....	.....

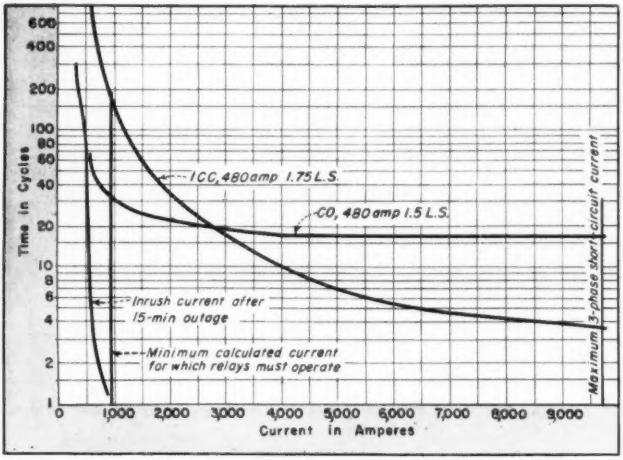


FIG 3—TIME-CURRENT CURVES for the relays as set for the staged test. The inrush current indicated is that following the 15-minute outage

have generally dismissed as unlikely the possibility of a satisfactory relay solution to this problem. Investigation and consideration of relays was apparently largely confined to the more commonly used inverse-time relays. Clearly, the less inverse types could not be used in any way as an answer, since it was on feeders generally using such relays that the difficulties were arising in practice. The record shows that some thought was given to the more inverse types of available, but less commonly used, phase relays, but with the conclusion that these would not solve the problem, although they were somewhat better. This possible clue was apparently pursued no further.

Various types and kinds of phase relays were reviewed and quite a few types were gradually, but definitely, dismissed as prospects. It was recalled that fuses, properly applied, have never been known to blow during feeder pickup. Since fuse characteristics are more inverse than those of phase relays previously considered, a more inverse relay characteristic was believed to be a possible solution. This led to consideration of an extremely inverse relay similar to the type ICC ground relay.

After checking the characteristic curves of this ICC relay quite thoroughly against the inrush data available, it appeared that this relay had definite possibilities for holding-in a feeder successfully against increased demands following outage, without sacrificing good protective characteristics in any way.

Since most of the inrush data were derived and were built necessarily on a multiplicity of assumptions, particularly as to magnitude values, it was obvious that there was only one way to be definitely certain as to whether or not this relay would be of real practical value. That one way was to test its performance on restoring an actual heavily-loaded urban feeder following an outage. It could only be tested properly by obtaining full data and records and this meant setting up test equipment and interrupting such a feeder while this equipment was in place. Since the answer to this problem was of vital public interest and importance, it was decided to proceed with arrangements for an actual feeder test.

It was decided that the feeder selected should:

1. Be a major city type feeder as nearly fully loaded as possible at time of daily peak load.

2. Have little or no industrial load (industrial motor load is restored by automatic control devices to only a negligible degree.)

3. Have as high a proportion of automatically controlled motor load as possible.

4. Have no hospitals, or institutions of similar character.

5. Be fed from a substation where the oscillograph and recording instruments could be completely set up and checked in advance and where such equipment would have proper protection.

6. Be in a city where mobile radio communication was available and where the necessary personnel could be conveniently brought together.

Two 4-kv overhead feeders in the City of Syracuse met all these requirements and were very similar in most respects, but the particular one selected controlled a few less street lights and was chosen for this reason.

The chosen feeder served slightly over 3,500 customers, no industrial load, and with one small local shopping center. It was well loaded and stood in actual danger of getting into restoral trouble after an outage, since the standard inverse relays had reached their limits of setting to give proper protection in the event of circuit faults. It was a completely typical city residential feeder with a large proportion of homes having high saturation of automatically controlled motors. The pre-test load checks showed that the feeder had a peak daily demand of 284 amp, which was actually 18% greater than the total connected distribution transformer capacity.

Time and Length of Test

To be fully effective the test was necessarily set for the time of daily peak on a day during the period of annual feeder peak. The week after Christmas but before New Year's was selected.

Length of test was set at 15 min in order to approach saturated outage time (most motors on such a feeder would have about a 20-min cycle) and to give time for getting the necessary data and readings while still keeping the outage as short as pos-

sible. It was decided to restore the feeder breaker for a six-sec interval after 5 min from the start of the outage, and again after 10 min, in order to obtain oscillograms of 5 and 10 as well as 15 min pick-up demand curves.

Three ICC relays to be tested on pickup were connected, one in each phase, to control the feeder breaker and were cut into service before the test outage began. The standard inverse relays (hereafter meaning either the "definite time standard energy" CO relay or the "inverse time" IAC relay) which had been in service on this feeder were left energized, but had their trip circuits disconnected from the breaker, and connected to light a lamp bulb if their contacts were closed by the feeder pick-up current. This was to show whether or not these relays would have tripped the breaker if such outage had occurred with these standard relays in service. Both sets of relays were given the same current-setting, 480 primary amp, and the same time-setting at approximately 5.75 times pickup.

Oscillographs and Instruments

A six-element PM-13 automatic oscillograph was connected, calibrated, check tested and loaded with fresh film just preceding the outage. This oscillograph had a film speed of travel of 1 FPs thus giving a spread of 1/5 in. to a cycle. With the oscillograms from this instrument, accurate records of pick-up characteristics of the feeder following outages of varying lengths, up to and including 15 min, were obtained.

A recording ammeter was in service showing phase currents in each phase of the test feeder for several days before the test and for a day after. It was cut out during the test to avoid damage on feeder pickup.

Observers were assigned to watch the movement of the contacts of both the standard and ICC relays as the feeder breaker was closed.

The feeder regulators had their controls cut out just before tripping the feeder. These controls were cut back in about 1 min after the fifteen-minute restoral.

At the time of the test it was dark, windy, and raining: the temperature was about 38 F. The test ran smoothly without trouble either during the experiment or after final restoral.

Relay Response

When the feeder was reclosed the first time at 6:20 p. m. the standard inverse relay disks barely started to move. The ICC relay disks must also have begun to move, since the pick-up setting of the ICC relay was the same as that of the standard relay, but no motion was discernable.

During the second reclosure at 6:25 p. m., the standard inverse relays practically completed their travel. The ICC relays moved less than 1/5 of their travel.

During the final reclosure, the standard inverse relays closed their contacts, lighting the lamp and indicating that the circuit breaker would have been tripped had the trip circuit been connected to these relays. The ICC relays moved less than 1/3 of their travel toward contact closure.

Inrush currents, as obtained from the oscillograph records for a 5-sec period after each of the three reclosures, that is, after 5, 10 and 15-min outages, are shown in Fig 1. Long-time recovery of the circuit is reflected in Fig 2. Normal peak current on these figures is considered to be the load current at the instant of the initial tripout. Recording ammeters showed this current to be only 10% less than the current that would have been interrupted had not the test been publicized. This reduction in current must have been largely in range load in anticipation of the test, since the survey showed that only 2.6% of the users disconnected motor load prior to the test.

Time curves of the ICC and the standard inverse relays are given in Fig 3. The standard inverse relays on this feeder were type CO "definite time standard energy." Type IAC relays with the "inverse-time" characteristic would have operated in substantially the same manner as did the CO relays. In comparing the time curves of Fig 3, the point at which the time curves cross may be open to discussion, since below 5.7 times pickup, the standard inverse relay is faster on faults than is the ICC relay, whereas the reverse is true above 5.7 times pickup. The really important consideration, however, is that if the standard inverse relay time curve were raised to the point where each relay was equally insusceptible to tripping on inrush current, the standard inverse operating times for nearby faults would be much too long, whereas the ICC relay reaches operating times of a few cycles at the high short-circuit currents. The inrush current on Fig 3 is that following the 15 min Syracuse outage. Fig 3 also shows the calculated short-circuit currents of the test feeder under which the station breaker must be opened by operation of its phase-overcurrent relays.

Details of the new relay will appear in the ensuing installment.

Night Life in Goodhue County

THE BOYS have enjoyed a couple of nights out lately, strictly stag. On April 26 the rains came and the winds blew with the result that one pole was blown over, four windmills were wrapped around main lines, secondaries and farmstead wiring, and trees put the line out here and there. Since then there has been nothing serious except a tree dropped on the line near St. John's Church by a county clearing crew and another windstorm last night which had Cecil and Stanley out from midnight until morning. There has been mighty little hand milking this spring and we hope there won't be any more. Better keep your fingers crossed.—

Goodhue County REA Reflector
Zumbrota, Minn.

AKRON'S MAIN STREET lighted by new 25,000-lumen, series type incandescent fixtures. Replacing an old arc system, luminaries have increased street illumination by 300%. To serve this wide street (80 to 110 ft), fixtures are mounted 30 ft high at 100-ft intervals

Downtown Akron Lighted with

Average street illumination increased 300% by change from 10,000 lumen magnetite arc lamps to 25,000 lumen series-type incandescents

R. F. HARTENSTEIN
Superintendent of
Electric & Steam Heat Sales
Ohio Edison Co
Akron, Ohio

AKRON'S ANSWER to the rising tide of traffic deaths on the streets of American cities is a program of street lighting improvement that will give the "rubber city" a downtown street lighting system that is the first of its kind anywhere.

World's Largest Luminaires

When it is finished this year, the lighting system for downtown Akron will have 181 of the world's largest street lights, 25,000 lumen giants that are 23 in. in diameter and almost a yard high. Dubbed "Big Jeffs" because of their size, these huge Form 108 luminaries use series or multiple type incandescent lamps rated as high as 1,500 watts. They are pendant type units and when hung from a bracket on a 30-ft steel pole they boost average illumination on the street 300%, at a cost only 50% greater than the old magnetite arc lamps they replace.

Besides these 25,000 lumen Big Jeffs, Akron's business area will have 50 15,000-lumen lamps and 88 10,000 lumen lamps, a total of 319 luminaires. They will consume 1,312,000 kwhr annually compared with 800,000 kwhr for the old arc system they have displaced.

But there is more to Akron's street light modernization than just the relighting of the downtown business section. In the three years since the war some of the more heavily traveled thoroughfares in the city have been provided with fixtures of greater intensity and new fixtures added. In three years 1,815 units have been installed at a cost to Ohio Edison Co of approximately $275,000. In 1949 alone, more than 1,000 units of all kinds will be installed costing the company approximately another $300,000. Taken altogether, Akron's city engineer has estimated that to provide adequate lighting for the city's streets will increase the street lighting bill from $260,000 to $900,000 a year.

How It All Began

Akron's street light modernization had its beginning during the war when city officials discovered that 58% of all traffic accidents were happening at night when there was only one-third as much traffic moving. This spurred the city to survey street conditions in cooperation with Ohio Edison Co and the Summit County Safety Council. General Electric en-

GIANT-SIZE pendant type unit diffuses some light upwards and embodies other features which tend to make it one of the best fixtures for creating "white way" lighting

25,000 Lumen Units

gineers from Nela Park were brought in to conduct light evaluation tests on streets in various sections of the city. They found that in many residential areas lighting was substandard. In the downtown area light was found better but glare was so high that 30 to 40% of the light value was lost to drivers and pedestrians. As a result lighting was far below accepted IES standards and requirements.

Old System Obsolete

Existing lighting in the downtown business area consisted of 342 upright-type 10,000-lumen magnetite arc lamps mounted on 15-ft ornamental posts. Installed in 1913, these lamps had long been obsolete. Repair parts and arc carbons were no longer available. To keep them going, Ohio Edison Co had to cannibalize the present system, replacing some units with incandescent adaptations. Any new lamp that was installed would increase the use of electricity above the prevailing 800,000 kwhr per year. However, it was evident that the increased cost would largely be offset by a much lower cost of maintenance.

Thus, with an eye on the city's budget, Ohio Edison Co began testing various street light luminaires, looking for one for the downtown area that would satisfy three general requirements: (1) Give long life with minimum obsolescence. (2) have minimum cost per lumen and (3) give illumination in excess of the requirements specified in IES standards.

Three test installations were made, early in 1946, using 15,000-lumen incandescent lamps, 16,000-lumen mercury lamps and 20,000-lumen mercury lamps in approved street lighting equipment and mounted at recommended heights.

All of these installations were a vast improvement over the old system but none of them entirely satisfied either city officials or Ohio Edison Co representatives. Single 15,000-lumen incandescent fixtures failed to provide the amount of illumination it was felt was needed, as did the mercury fixtures.

But success was not far off. Late in 1947 company representatives saw the prototype of a new incandescent luminaire which had been developed by General Electric but not yet in production. Upon request, however, a special order of eight lamps was made up for test installation on Akron's Main Street.

These new units were designed to use either 25,000-lumen, 20-amp series lamps or 1,500-watt multiple lamps. When city officials saw the results of the test installation they readily agreed on the new "Big Jeff" fixture as a solution to their downtown area lighting problem. They then directed Ohio Edison Co to install 181 of these 25,000-lumen lamps in the place of over 200 of the magnetite arc lamps.

The first 65 units were placed in service in December of 1948; 116 more will be installed during 1949. Under the agreement between the city and Ohio Edison Co, the new lighting system was installed at the company's expense, the 65 units representing an investment of approximately $25,000.

It was decided to use the 25,000-lumen series lamps, and mount the units with the light center 30 ft above the pavement. Fixtures were mounted on a 6-ft upsweep bracket fabricated from 2-in. pipe. The tubular steel poles were designed to support the trackless trolley wires also, thereby reducing duplicate poles along the main thoroughfare. The average spacing of units is 100 ft.

Big Jeff Specifications

Specific information on the unit is as follows:

1. It has a large die-cast aluminum exterior housing with an internal reflector designed to give a broad asymmetric distribution of light.

2. The physical shielding of the lamp filament is 25 deg below the horizontal, which is 10 deg lower than a conventional unit of smaller size.

3. Maximum candlepower is about 30 deg from the curb.

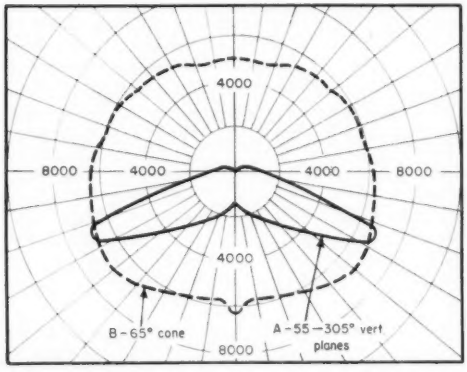
4. The reflector is also designed so that the reflected energy bypasses the vulnerable parts of the lamp.

5. The globe is made of blown glass with "rippled" exterior.

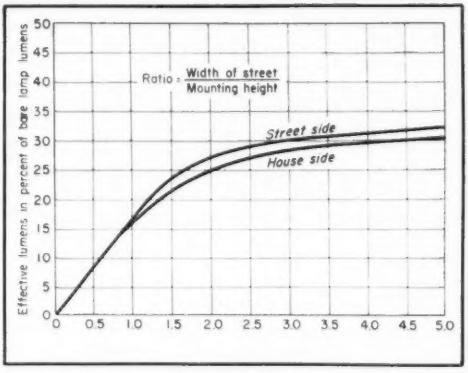
6. The total height of the unit is

NEW AND OLD. Shown in foreground is disconnected 10,000-lumen arc lamp standard that has been replaced by "Big Jeff" unit in back of it. Poles will support trolley bus wires as well as luminaires

STREET ILLUMINATION was increased 300% at cost increases of only 50% by switch from magnetic arc lamps to "Big Jeffs." In addition, 30-ft mounting height eliminated objectionable glare



LIGHT DISTRIBUTION of original candlepower from "Big Jeff" luminaire. Maximum candlepower is about 30 deg from the curb



UTILIZATION CURVE gives effective lumen output of fixture on house and street side for ratio of street width to mounting height

approximately 3 ft and the diameter of the housing is 22¾ in.

These features of the new unit tend to make it one of the best fixtures for "white way" lighting. The specially constructed globe diffuses some light upwards, thereby improving the appearance both of the street and the building fronts. The globe also prohibits an excess of light being thrown into the sky and wasted, as was the case with the old fixture. The 30-foot mounting height did away with the objectionable glare which was cast directly into the eyes of drivers and pedestrians.

Energy is supplied by overhead series circuits. Polyethylene wire, a new type of insulated wire developed during the war, is used. Standard 5,000-v insulators are used on top of each pole.

Each circuit is so protected that it is de-energized in a fraction of a second if the wire should break. Service is supplied by constant current transformers with the circuit grounded at mid-point, thus reducing the voltage to ground to a minimum.

Use of the new type "Big Jeff" unit is restricted to the downtown business area. In other areas lighted by luminous arc lights, conventional type units using 15,000-lumen and 10,000-lumen incandescent lamps are being installed.

SILVER CONTACT SURFACES

to eliminate oxidation troubles

AT NO INCREASE IN PRICE

POWER CONNECTORS

SILVER is used exclusively on *all* G-E connectors because it allows power to flow between conductor and connector with no losses or overheating. This helps eliminate annoying oxidation problems that are a definite maintenance item. The more a connector heats up, the more it oxidizes; and the more it oxidizes, the more it overheats. This vicious cycle continues until the connector fails.

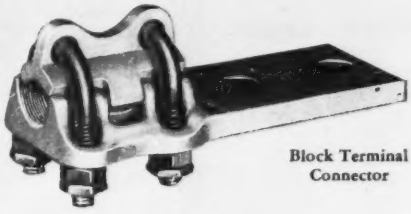
CORRECT MATERIAL for the job is another feature assuring you that G-E connectors "run cool." The composition of the alloy used permits the connectors to carry the maximum current of any conductor on which they are used . . . with no losses and without overheating. By using G-E connectors you're assured of long connector life because of silver contact surfaces and ample current-carrying capacity; double safeguards against oxidation troubles and they don't cost you a cent extra.

CHECK THESE ADDITIONAL FEATURES . . .

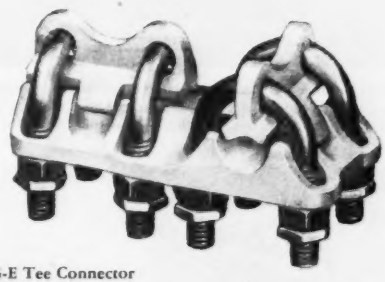
SERRATED CONTACT SURFACES give extremely high pull-out strength and a permanent, high-conductivity joint that will resist vibration and give positive pressure on the conductor at all times.

NON-CORRODIBLE HARDWARE is of high-strength bronze alloy that gives tight and trouble-free service. G-E connectors will not twist, distort, or season crack.

INTERLOCKING SIDES confine the strands of the conductor within the conductor enclosure, thus obtaining full advantage of the conductor's current-carrying capacity.



Block Terminal Connector



G-E Tee Connector

Place an order today with your G-E sales representative and start realizing the many benefits to be gained by using this new line of General Electric connectors. Also, write for a copy of bulletin GEC-400 that contains 40 pages of valuable information on G-E connectors, and see for yourself how easy they are to order. Write to *Apparatus Department, Section 856-52, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

300-kva Transformer Banks Installed on One Pole

R. T. FISHER
Design Engineer—Standards
Union Electric Company of Missouri
St. Louis

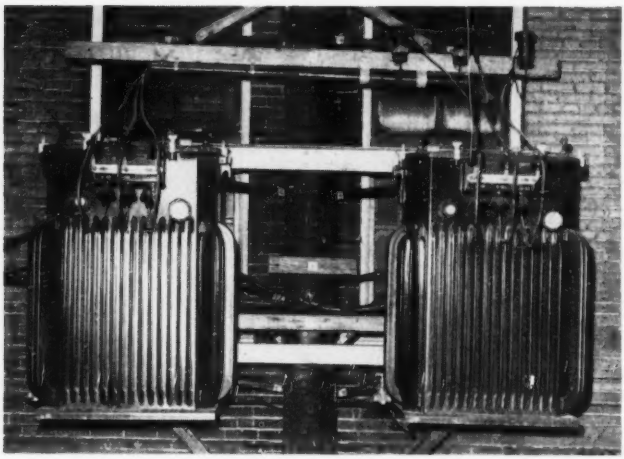


FIG 1—PLATFORMS and two-pole structures are not necessary with the new design and where poles are against buildings climbing space is provided on the front of the pole as shown. One design takes care of sizes up to two 150 kva and the other up to three 100 kva

FIG 2—CAPACITY totaling 450 kva is installed on two adjacent single pole jobs. The two transformers in the foreground are 150 kva each and those farther from the camera are 75 kva. Added capacity can be obtained by replacing the 75's with 150's

SPACE and other limitations have in some sections of St. Louis made it impractical to provide platforms for transformer banks of 150 to 300 kva. To avoid the problems and costs involved in providing small indoor substations for such installations, two separate single-pole designs of banked transformers were prepared, as shown in the illustrations on this page and a detail drawing on the next page.

Two Designs Are Used

The first design for sizes up to three 100-kva single phase transformers is intended for locations where a platform cannot be used but climbing space can be made available on the back of the pole.

The second employing up to two 150-kva three-phase transformers in parallel, is intended for use on poles so close to buildings that climbing space must be provided on the front of the pole between transformers, as shown in Fig 1.

To support the weight of such installations (about 8,000 lbs) the main member consists of a 6 in. x 3½ in. x 10 ft. 0 in.—15.3 lb ship channel reinforced with knee braces for vertical stability and 60 in. wood V-braces for horizontal rigidity. This member is also tied into the kicker assembly with wood vertical slab braces. The kicker assembly was originally comprised of 2-3¾ in. x 4¾ in. x 10 ft crossarms, braced with knee and V-braces in a manner similar to the bracing of the main member.

On present designs the double arms in the kicker assembly have been replaced with a ship channel of the same section and weight as the

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TO RECORD

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STRAIN	VIBRATION
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Permanent, accurate records are a necessity in many development tests, laboratory investigations, and research projects. That's where the G-E photoelectric recorder can help you. These versatile instruments can record almost anything that can be measured by an indicating instrument.

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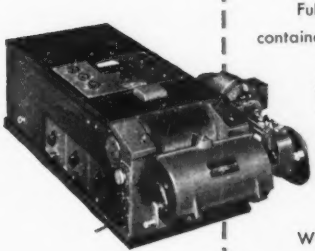
EASY TO USE The CE recorder is compact, weighs but 35 pounds. Power supply is entirely self contained. By a simple adjustment chart speeds from ½ inch per hour to 72 inches per minute are available.

Full information on operating principles, ratings, and prices of the Type CE is contained in bulletin GEC-254. Write for your copy today.



record and view too!

PM-10 OSCILLOGRAPH

With the Type PM-10 oscillograph you can record the data and view it simultaneously, aiding in the investigation or testing of many machines or devices.

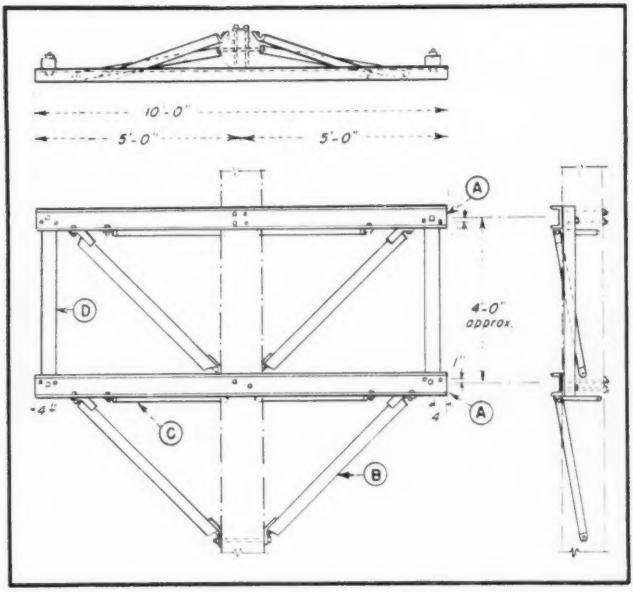
The PM-10 can be furnished with any number of galvanometers up to 12, permitting a choice of sensitivity and frequency response. Oscillograph deflection can be in terms of any measurable electrical quantity. By using intermediate equipment, deflection can be made proportional to many non-electrical quantities.

Easy and convenient to use, the PM-10 has hinged covers all over galvanometer and optical compartments. Timing lines can be photographed directly on the film. For convenience, every tenth line is indicated. Full description in bulletin GEC-449.

For assistance with any problem in measurement or recording of measurement, use the experience of G-E engineers. Contact your nearest G-E Sales Office and let us help. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

GEE-107



main member, to eliminate excessive deflection. This design permits hanging a single 150 kva three-phase transformer without any visible evidence of distortion.

Class I Poles Are Used

Class I poles are used for these installations and no serious displacement of the pole top has occurred. However, since wood tends to bend progressively under continuous loadings, a $\frac{1}{4}$ in. guy has been used to successfully counteract this unbalanced condition.

This type of installation has been in service in St. Louis for three years and so far no trouble has been experienced.

FIG 3—STEEL CHANNELS, 6 in. x $3\frac{1}{2}$ in. x 10 ft, 15.3 lb, provide adequate strength in positions *A*. Use 5 ft wood heel braces for *B;* 60 in. wood V-braces for *C;* and 48 in. slab braces for *D*, to provide a sufficent amount of support and to eliminate distortion

Sleeve Protects Cable at Pipe Entrance

L. F. GREVE
Corrosion Engineer
Commonwealth Edison Co
Chicago

LEAD SLEEVES are effective in protecting cable sheaths from serious corrosive attacks where the conductor enters a brass pipe in the station. This method was used successfully in one distribution station where a large number of brass cable entrance pipes had been previously installed.

From a design standpoint, the nonmagnetic brass entrance pipes reduce losses on the many entering single conductor cables, and also are more durable than iron pipes. But from a cable sheath corrosion standpoint, the brass and lead theoretically would form a galvanic couple with the lead sheath anodic.

On most of the cables, a protective lead sleeve was wiped on the portion of the cable passing through the brass entrance pipe, as shown in Fig 1. This does not eliminate the galvanic couple, but protects the cable sheath by first subjecting the lead sleeve to any galvanic action present.

Approximately ten years after the installation, one of the two cables installed without the protective sleeve failed because of corrosion. The sheath was seriously corroded around the point of failure, which was 3 in. inside the brass entrance pipe. Also, there were many small pits along the

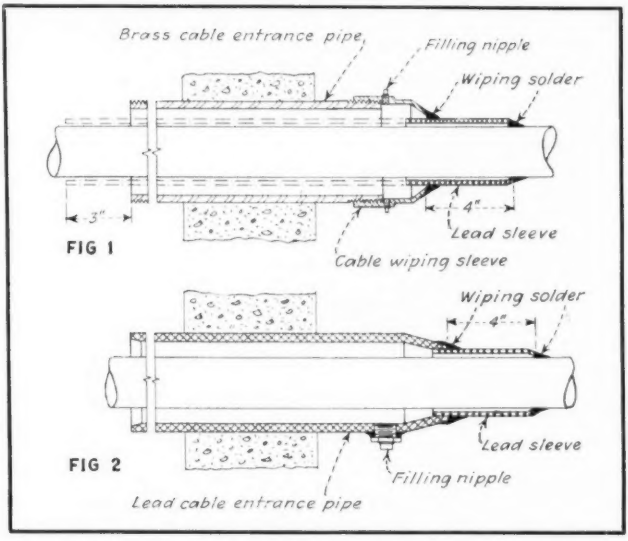
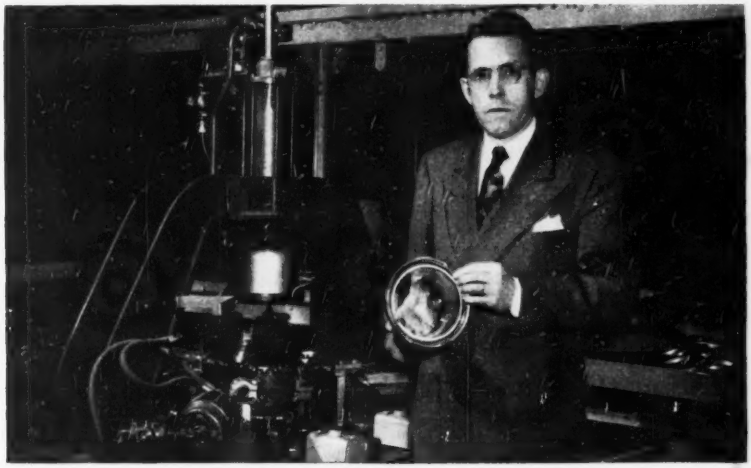


FIG 1—BRASS cable entrance pipe requires protective lead sleeve to prevent corrosion
FIG 2—LEAD-ALLOY cable entrance pipe prevents corrosion; eliminates galvanic couple

— *how you are assured*

— *lower maintenance costs with*

— **new** *watthour meter, type I-50*



This 3-head welding machine is one of the many pieces of equipment designed especially for I-50 production. It automatically welds clips to cover rings. This is a small operation, but it's typical of many such operations that all contribute to the accuracy and uniformity of the I-50.

When we assure you of lower maintenance costs with the I-50 meter, we give you our personal *assurance. This comes directly from the people here who build I-50 meters.*

We're proud of the outstanding engineering design behind new features like the magnetic suspension of the rotating element. But we realize that these new features can only be as good as we make them.

So, we employ only specially trained personnel. We have provided them with the best and newest in manufacturing facilities. And, we have in operation a system of rigid quality control.

All this is backed by strong enthusiasm on the part of individual employees—a determination to make the best watthour meter General Electric has ever built.

L. P. Hannaway

Plant Manager
Somersworth, N. H.

Type I-50, the first completely new watthour meter in 50 years

Order now from your nearest G-E representative. I-50 meters are available in socket- or bottom-connected types with pointer or cyclometer register. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

Exclusive Features for Lower Maintenance

1. Co-ordinated insulation—for better performance under adverse conditions.
2. Magnetically suspended rotating element—to do away with bearing maintenance.
3. Braking magnets die-cast in frame—to assure calibration stability.
4. Current coil molded in butyl and potential coil in polyethylene—for greater insulation and stability.
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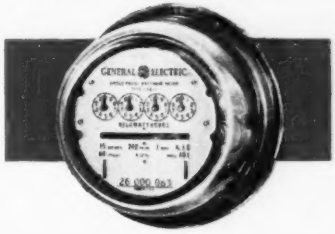
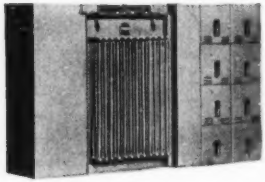


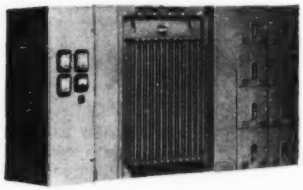
GENERAL ELECTRIC

New load-center unit

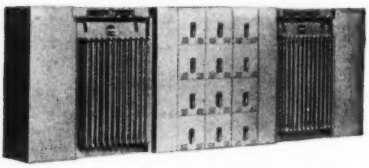
Shorter shipments, when you order 'Selected Standards'



Typical 500 kva G-E *selected standard* load-center unit substation (standard arrangement). Unit consists of primary interrupter switch, liquid-filled transforming section, and low-voltage feeder switching section with the new Type AK-1 drawout air circuit breakers. Reverse arrangement is also available at same price.



Typical 500 kva G-E *selected standard* load-center unit substation with liquid-filled transforming section, metal-clad air power circuit breaker for incoming line-protection, and low-voltage feeder switching section with the new Type AK-1 drawout air circuit breakers.



G-E *selected standard* double-ended load-center unit substation rated 1500 kva with primary interrupter switches, liquid-filled transforming sections, and low-voltage feeder switching section with G-E Type AK-1 drawout air circuit breakers arranged for secondary selective service.

Based on surveyed demands of industry and proposed NEMA specifications, *selected standard* ratings have been introduced by General Electric to bring you these efficient new load centers on shorter shipment. The most popular *selected standard* ratings are . . .

Low voltage	480△ or Y, 208Y/120 volts
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Kva ratings	300, 500, 750, 1000, 1500, 2000

Certain other *selected standard* load centers are available. Contact your G-E sales representative for further information.

SHORTER SHIPMENTS By ordering *selected standards*, you get 20 per cent shorter shipments on Pyranol and dry-type load centers. Deliveries are in line with average plant construction schedules and it is suggested that load centers be ordered when construction begins.

HIGH IMPULSE LEVELS Pyranol unit substations with their inherently high impulse levels are particularly suitable for locations that are subject to switching surges and lightning.

ECONOMICAL, too, is a G-E load-center power distribution system . . . no heavy, costly low-voltage feeders, no "piecemeal" purchases, no divided responsibility.

SAVE TIME, also, because G-E *selected standard* load centers eliminate weeks spent over drawing boards detailing individual items; you'll save time because G-E factory-assembled unit substations are quickly and easily installed—in the center of the load area—with lower material and labor costs then required for "piecemeal" assemblies.

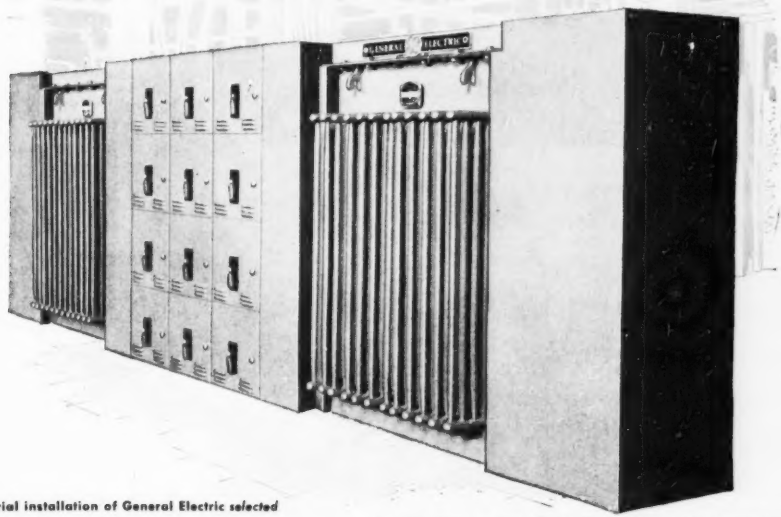
Ask your G-E sales representative *today* about how *selected standard* load centers can save time and money in *your* plant. Also, write for Bulletins GEA-3592 and GEA-3758. *Apparatus Department, General Electric Co., Schenectady 5, New York.*

substations give you...

Improved appearance

at no extra cost!

Note the smooth, integrated appearance of these new General Electric Pyranol* unit substations . . . no more gawky, "old-type" stovepipe connections between transformer and switchgear . . . now you can get the effortless flow of line and power that characterizes quality equipment for locations where appearance is a requisite. All these features at the same price as previous units.



Industrial installation of General Electric selected standard double-ended load-center unit substation rated 1500 kva, 4160 volts, 208Y/120 volts. Unit has oil cutout in incoming line sections, Pyranol-filled transformers, and the new AK-1 drawout air circuit breakers.

***Reg. U.S. Pat. Off.**

★ *Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.*

GENERAL ELECTRIC

321-60

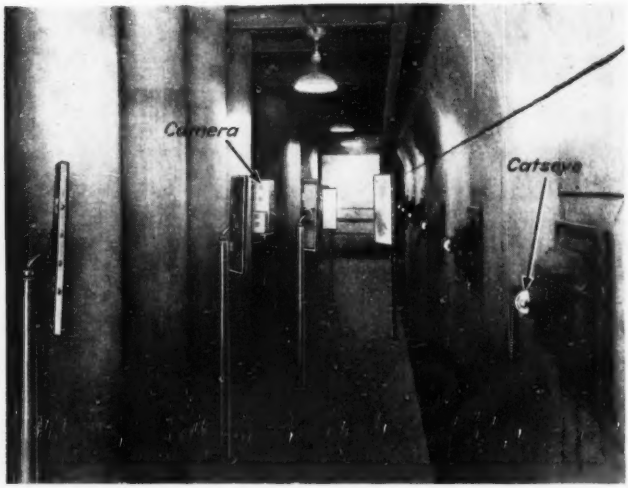
bottom of the cable where it made contact with the brass.

Further examination of other cables showed those protected by a lead sleeve to be in good condition. But the unprotected cable sheath and the protective lead sleeves were pitted up to a 40-mil depth.

To reduce corrosion on the protective lead sleeves, a cable lubricating compound is pumped through the plug on the wiping cap of the brass entrance pipe. This fills the space between the lead sleeve and the brass pipe, minimizing contact areas and excluding moisture.

On old installations using brass pipe, standard practice is to install a protective lead sleeve on the cable as previously described. On new installations where standard galvanized iron pipe is considered unsatisfactory, as shown in Fig 2, lead alloy entrance pipe prevents corrosion.

Television Registers Pilot Burner Flame



CATSEYES show whether pilot burners are "on" or "off" in boiler furnace. Six catseyes are watched by one "Utiliscope" camera using mirrors to receive reflections

SIX GLOWING DISKS (one for each catseye) are seen by control room operator on "Utiliscope" receiver and indicater that all pilot burners are burning satisfactorily

INCREASED EFFICIENCY and safety in boiler operation have been effected by means of wired television. A new use for video equipment was developed by engineers of American Gas and Electric Service Corp. The initial installation was made at Tidd Station of The Ohio Power Co. Known as the Utiliscope, this video system is manufactured by Capehart-Farnsworth Corp and Diamond Power Specialty Corp.

This new use for the equipment is to check boiler pilot burner flame conditions. It enables the control room operator to see for himself (without an observer on firing floor) whether the burner pilots in a boiler are "off" or "on". As indicated by the illustrations, the transmitter or camera is focused upon a master mirror which receives reflections of six catseyes from smaller individual mirrors. In this way flame conditions at six different points in the furnace are watched by one camera.

From the transmitter located on the sixth floor the image of the flame conditions is carried by coaxial cable directly to the viewing unit. The receiver or monitor is built into the control panel where six glowing disks indicate to the operator that all pilot burners are lighted and the main burners can be turned on with safety.

Previous to the flame image transmission, the control room operator and an operator located at the furnace burner area communicated over a public address system. This method could lead to confusion, delay and hazardous practices during the critical period of lighting the burners to bring the boiler into service.

Another application at the same plant is the reading of boiler drum water level at the control panel. In this latter installation, transmission is also by wire.

SEE REVERE

FOR CONDENSER TUBES AND PLATES

EXPERIENCE has proved that in a majority of installations Revere Admiralty Metal condenser tubes, inhibited to resist dezincification, will give long, satisfactory and economical service. However, Revere also makes tubes in Cupro-Nickel, Revalon (aluminum brass), Red Brass, Muntz Metal, Arsenical Copper, and Copper, thus enabling you to select the Revere Metal or Alloy best suited to meet your operating conditions.

In addition, Revere manufactures pipe and tube in copper and brass for general piping purposes, and electric welded steel tube.

Revere condenser plates can be had in a number of alloys in squares, rectangles, circles, half-circles, segments, and special patterns. These plates are flat, dense, free from blow holes or other imperfections, accurate in gauge, and are easily machinable.

As each condenser, heat exchanger or other piece of equipment using tubes and plates presents an individual combination of conditions, no blanket recommendations are possible. Among the factors to be considered are: chemical and impingement attack, velocities, pressures, temperatures, air entrainment, suspended solids. Should short tube life or other circumstances lead you to question your present practices, the Revere Technical Advisory Service will gladly cooperate with you in making thorough field and laboratory studies, to assist you to determine the most serviceable and economical alloys.

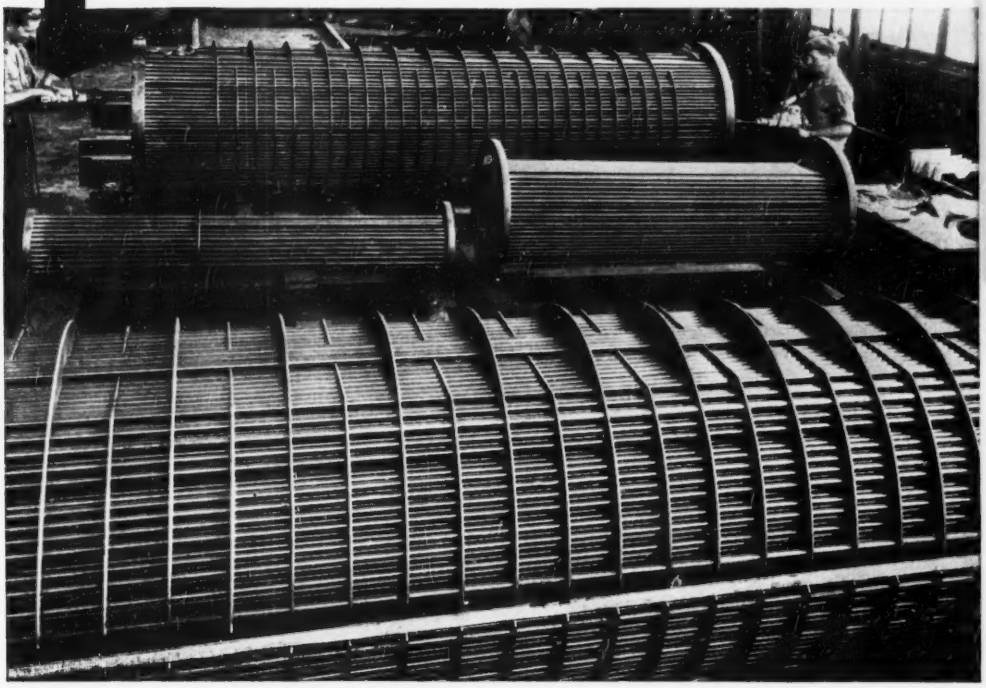
REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities. Distributors Everywhere.



Selection of Lamps For Specific Seeing Tasks

ARTHUR A. BRAINERD, Illuminating Engineer, Market Studies & Service Div, Philadelphia Electric Co, Philadelphia, Pa.

Comparison of Light Source Characteristics on Basis of 15,000 Lumens Output

	Incandescent	High Intensity Mercury	40-w Fluorescent, Pre-Heat Start	40-w Fluorescent, Instant Start	75-w 96-in. Slimline, 425 ma	96-in. Slimline, 200 ma	96-in. Slimline, 120 ma	20-mm, 93-in. Cold Cathode, Multiple 120 ma	20-mm, 93-in. Cold Cathode, Series 100 ma
Total Light Source Length (Sum of all lamps), inches	0.75	6	325	325	282	470	658	623	623
Diameter, inches	0.5	0.25	1.5	1.5	1.5	1	1	0.8	0.8
Life, hours	1000	3000-5000	4000-6000	4000-6000	4000-6000	4000-6000	4000-6000	10,000	10,000
Depreciation (70% Life)	15	13-18	24-30	24-30	24-30	24-30	24-30	22	22
Number of Lamps	1	1	7	7	3	5	7	7	7
Number of pieces of Auxiliary Equipment	0	1	3.5	3.5	1.5	2.5	3.5	3.5	1
Number of Electrical Contacts	2	4	42	21	9	15	21	21	14
Number of Moving Parts	0	0	7	0	0	0	0	0	0
Weight of Auxiliary Equipment, pounds	0	28	24.5	35	32	35	35	63	50
Initial Cost of Lamp, dollars	3.50	10.50	7.00	7.00	9.75	13.50	18.90	33.60	33.60
Initial Cost of Auxiliary Equipment, dollars	—	20.90	22.40	31.50	24.00	27.40	30.60	45.50	42.60
Lumens Per Watt Initial (Overall)	20.6	35	48	43	51	48	48	44	35
Starting	Inst.	5 Min	A few seconds	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.

CASUAL CONSIDERATION of trends in lighting acceptance over the past 16 years (since the advent of the high intensity mercury lamp) would lead one to believe that the public in general is seeking only higher efficiency when purchasing lamps. However, when we examine modern lighting practice critically, we are forced to the conclusion that such is not the case. Since 1933 every major development in light sources has resulted in a lamp having a greater area for the same light output and, of course, a lower brightness.

In general the public preferences in light sources may be classified as follows:

1. Size—The bigger the better.
2. Life—The longer the better.
3. Simplicity, reliability—Fewer pieces of equipment, minimum number of electrical contacts, no moving parts.
4. Maintained performance—Low depreciation.
5. Initial cost—Low costs are always popular.
6. Efficiency—High, although seldom checked.

Records indicate very clearly that in general, purchasers are only mildly interested in efficiency (lumens per watt) and still buy concentrated light sources where this lamp will meet the needs of the seeing task.

Accompanying table lists the characteristics of commercially available light sources. Comparison is made on the basis of approximately 15,000 generated lumens. All fluorescent lamps are 3,500 deg.

The table may be used to select lamps on a performance basis. Final selection will, of course, depend upon the relative weight which is given to various characteristics. For example, emphasis on initial cost would lead to the selection of incandescent; where high efficiency is the deciding factor, 425-ma Slimline would be chosen; and where long life is the criterion, cold cathode would be selected, etc.

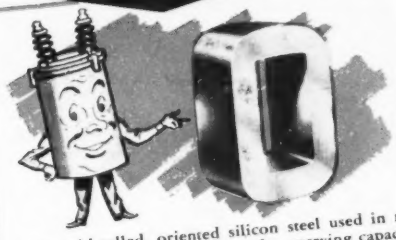
In general, the customer will prefer package equipment to custom built. Long life will frequently offset the disadvantages of lower efficiency. The incandescent lamp, because of its short life, returns to new condition oftener, thus resulting in generally better lumen maintenance. It pays to study the lamp in relation to the particular job.

I'm built to take it ...and DELIVER!

RAIN OR SHINE... it makes no difference! Load me or *overload* me, I'm built to take it ... from the top of my bushings right down to the bottom of my cold-rolled, oriented silicon steel core. Moloney engineers considered everything that could possibly happen to a line transformer and went to work to design a transformer to do the job better. I'm the answer ... literally a test-tube baby ... *lighter, smaller, better* ... with a "Surge-Tested" Design pedigree!

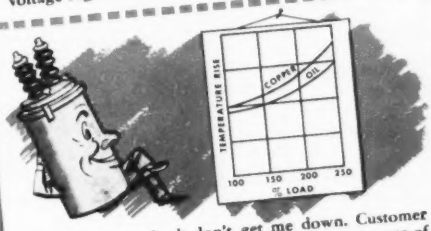
ME49-10

Here's WHY

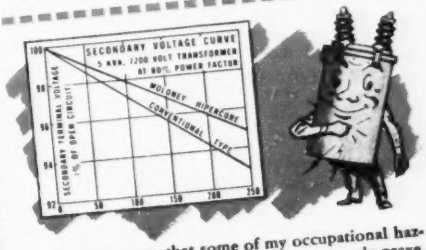


The cold-rolled, oriented silicon steel used in my core has 30% to 35% greater flux carrying capacity than non-oriented steel. In 3 Kva size I weigh but 125 lbs. including oil, and with CSP attachments only 140 lbs. Yet with less weight I have greater short-time overload capacity and provide better voltage regulation.

Because my cores are smaller, so is my coil. This reflects not only in my weight, but in my size. Ordinary transformers of the same Kva up to 30% larger find difficulty in performing tasks I consider routine. Besides, I don't need nearly as much space in the storeroom, on the line truck, or on the pole.



Short-time *overloads* don't get me down. Customer loads, being what they are, anyone with an ounce of temperature gradient knows that heavy peak overloads are inevitable. So I just keep calm and am thankful for my generously proportioned cooling ducts and maintain a lower hottest-spot-over-oil temperature.



My engineers say that some of my occupational hazards send many young transformers to an early grave. They tell me not to worry though, because my rugged constitution can take these hazards in stride and that I will live a lot longer on the job than many of my contemporaries ... and perform better!

Illustrated: 5 Kva, 7200 to 120/240 volts Conventional Type HiperCore Transformer.

Send for Bulletin H-303 for complete details of HiperCore Transformers.

MOLONEY ELECTRIC COMPANY

Sales offices in all principal cities

FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONTARIO, CANADA

Methods of Pole Bracing

Six ways to brace poles; adapted from construction methods of the Pacific Power and Light Co, Portland, Oregon

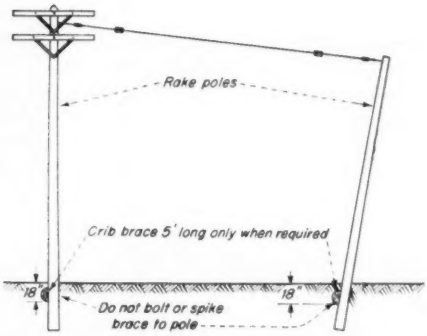


FIG 1—Guying to stub without stub anchor guy; to be used only where impossible to guy the stub

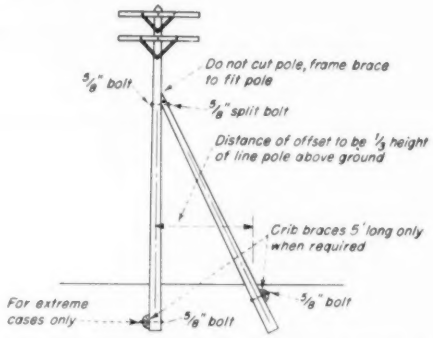

5/8" bolt
Do not cut pole, frame brace to fit pole
5/8" split bolt
Distance of offset to be 1/3 height of line pole above ground
Crib braces 5' long only when required
For extreme cases only
5/8" bolt
5/8" bolt

FIG 2—Push pole brace; to be used only where impossible to guy the pole

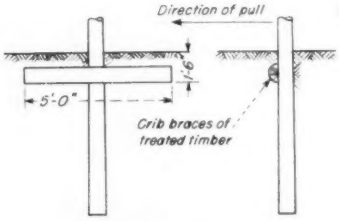


FIG 3—Crib braces

Note: This method of bracing may be used, where specified, for reinforcing a pole where a guy cannot be installed

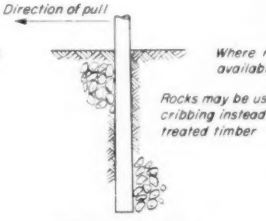


FIG 4—Rock cribbing

Note: This method of bracing may be used, where specified, for reinforcing a pole where a guy cannot be installed

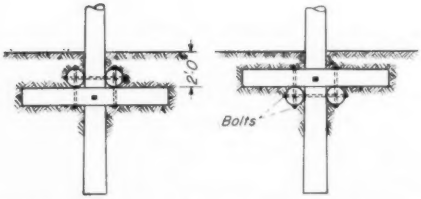


FIG 5—Bog shoes; should be used in soft or swampy ground where it is impossible to guy or set the pole so that it will be sufficiently rigid. Shoes are made of 12 in.x6 ft sections of old creosoted or similarly treated wood poles, securely fastened to the pole as shown

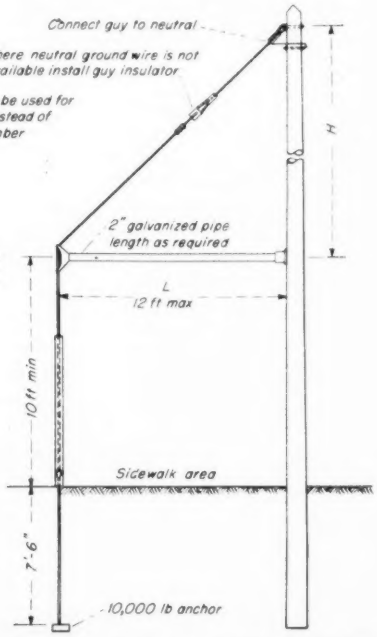
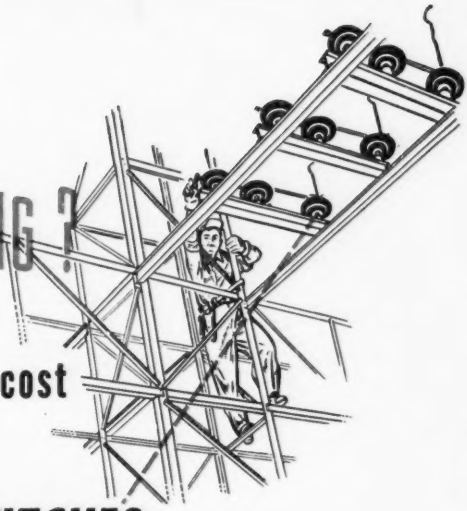


FIG 6—Sidewalk guy; to be used where space is not available for straight guy. Otherwise it is not to be used

Rating: If L/H = 1 then rating is 0.7 of guy strength
If L/H = 0.5 then rating is 0.5 of guy strength

WHAT IS HE DOING?



Reducing switch installation cost 20 to 40% by installing

HI-VOLTAGE SWITCHES

HERE'S WHY... Every operating disconnect switch carries an expense in addition to its purchase price. From crate to operating position represents man hours and dollars.

It will pay you to examine your switch installation costs. Compute, as we did, the cost of field cutting and drilling . . . the cost of parts identification . . . the cost of field fitting . . . the cost of final adjustment. Add them up. This is the saving that Hi-Voltage Switches offer.

The Hi-Voltage Switch Operating Mechanism is pre-machined and pre-fitted at the factory. All parts are positively identified . . . keyed to easy-to-follow installation data. Every Hi-Voltage Switch is completely assembled and tested before shipment. This is the work we save your construction crew.

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HI-VOLTAGE EQUIPMENT COMPANY

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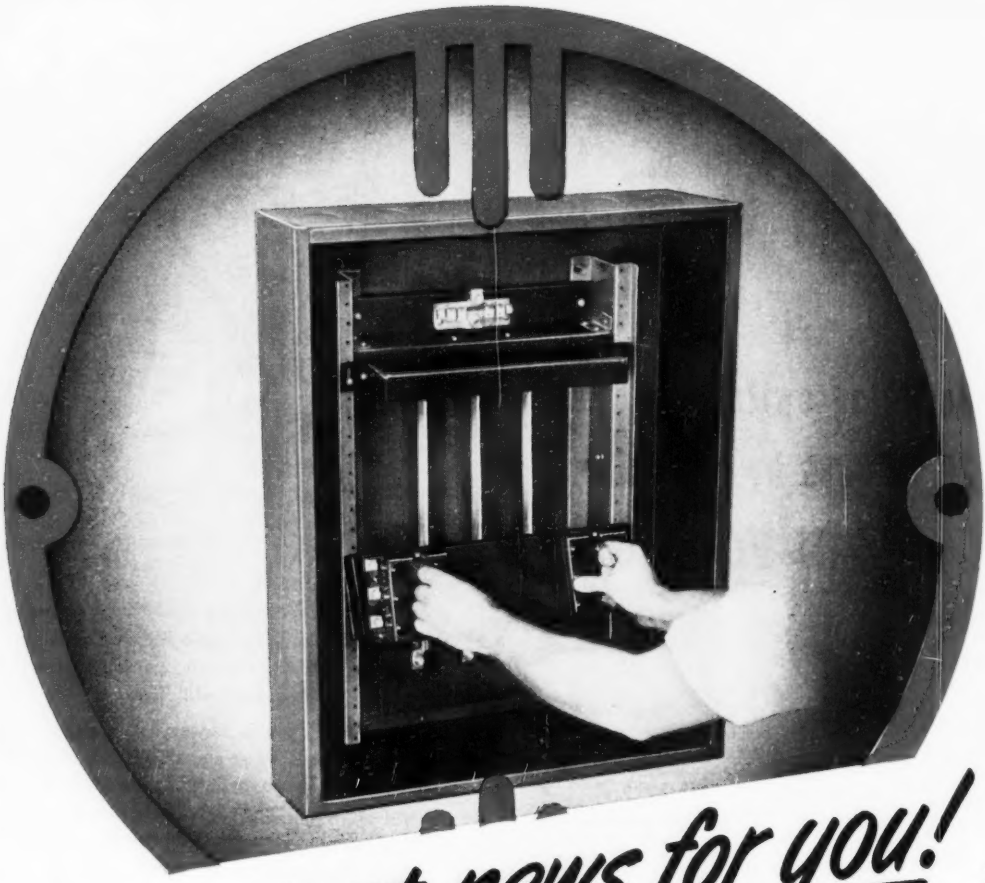


Important news for you!

Lowest prices! Fastest installation! Instant delivery!

. . . Now you can assemble in minutes the new, exclusive

Federal Noark Flexunit Plug-In Distribution Panelboard

IN THE DISTRIBUTION PANELBOARD FIELD the whole picture has been changed by a brand new Federal Noark development. Now you can assemble Plug-In Distribution Panelboards to your exact requirements – from the wholesalers' stock of standard parts. It takes only minutes . . . slashing installation costs. No more waiting for factory assemblies. And what's more, through mass production the Federal Noark Flexunit Plug-In Distribution Panelboard sells for less.

Four standardized surface cabinets in two sizes of main lugs (200 and 400 ampere), provide for a maximum of:

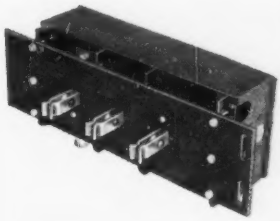
★ Twenty-four 30 ampere, 3 pole, 230 volt or sixteen 60 ampere, 3 pole, 230 volt branches in a panelboard for 230 volt service.

★ Lesser combinations of 30, 60, 100, 200 ampere, 230 volt units may be assembled in a Flexunit Plug-In Distribution Panelboard.

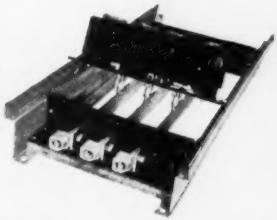
★ Filler plates to cover unused spaces are available in four sizes.

Start cashing in today on the faster service and lower prices that are offered by Federal Noark Flexunit Plug-In Distribution Panelboards. Mail the coupon for complete data on this revolutionary new improvement. Federal Electric Products Company, 50 Paris Street, Newark 5, New Jersey.

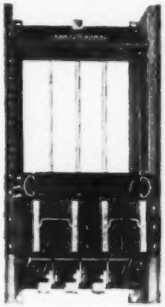
1 Federal Noark chassis has three silver-plated copper bus bars, of 200 or 400 ampere rating, arranged on edge to receive the plug-in units. Spacing ample for 575 volts! Neutral provides for 3 phase, 4 wire; and single phase, 3 wire services.



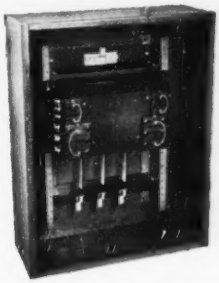
2 The rugged plug-in Flexunits are complete with fusible pull switches. They are available with twin 30, twin 60, 30-60, twin 100 and single 200 ampere switches for 230 volts A.C. Plug-in stabs have proved their value in Federal Bus Duct and Control Centers.



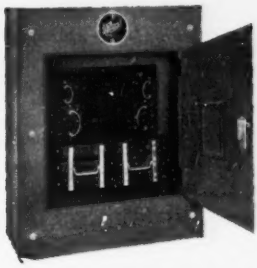
3 Snap! . . . and the Flexunit is in place. When secured by screws, the popular Wurdack pull switch units are ready to operate with a simple pull, turn and push. Designed for absolutely positive action, they clearly indicate "On" and "Off" positions.



4 Here, mounted in the chassis are two plug-in Flexunits. Unused space can be covered with filler plates giving a dead front panel when the panelboard is completed. Then additional Flexunits can be added simply, easily, as needed.



5 Note the ample gutter space available when chassis is mounted in the box. At the top are the neutral bar and terminals so that panel can be used on the increasingly popular three phase, 4 wire service, as well as on single phase, 3 wire service.



6 The completed Federal Noark Plug-In Distribution Panelboard assembled with twin 30, twin 60 and twin 100 ampere fusible Flexunits and narrow filler unit at top. Both box and trim are code gauge steel, complete with standard hardware.

7 All essential elements of the new Plug-In Distribution Panelboard have been proved through years of outstanding service. The plug-in stabs are a well-known feature of both Federal Noark Bus Duct and Control Center plug-in units. The Wurdack pull switch units are recognized as standard, everywhere! Get the complete facts. Mail the coupon, right now!

Federal Electric Products Company,
50 Paris Street, Newark 5, New Jersey

Gentlemen: Please send me full data on the Federal Noark Flexunit Plug-In Distribution Panelboard for better service, lower installation costs.

My name .....

Company name .....

Address .....

City ..... Zone ..... State .....

Name of our wholesaler .....

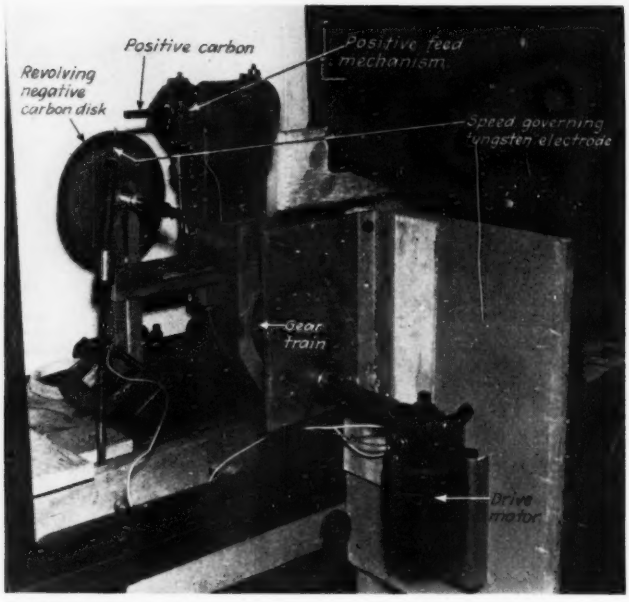
.....

FEDERAL NOARK

FLEXUNIT PLUG-IN DISTRIBUTION PANELBOARDS

Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

Long-Life Arc-Light Uses Thick Carbon Disk



EXPERIMENTAL MODEL of revolving negative carbon disk arc-light

CARBON ARC lamps with 30 times the normal expected uninterrupted illumination time may soon be available as a result of experiments being performed by scientists at the Engineer Research and Development Laboratories, Fort Belvoir, Va.

More than twice as bright as the present standard 60-in. military searchlight arc, the experimental lamp has two new components of unique design. Instead of the conventional negative carbon rod the lamp uses a 12-in. diameter, $\frac{1}{4}$-in. thick carbon disk. During tests, the disk lost only 50 grams of weight in eight hours of operation.

The arc is formed between one end of the positive carbon and the edge of the negative disk. Due to the nonuniform magnetic field around the arc proper, there is a tendency for the cathode spot or "foot" of the arc to move slowly out on the disk away from the carbon.

"Foot" Movement Compensated

To compensate for this action, the disk is rotated by a small motor. For power, the motor is connected to the positive carbon and a small $\frac{1}{8}$ in. tungsten electrode that is positioned just behind the "foot" near the edge of the negative disk. As the "foot" moves out, the arc flame contacts the tungsten electrode which impresses a voltage on the motor, driving the disk forward.

Because of operation at 200 amp, the positive carbons are consumed at a rate of approximately 40 in. per hour, or three times as fast as those of the standard military searchlight. To avoid spluttering these carbons are liquid cooled.

Combining the accumulated advantages of the revolving-disk negative carbon and liquid cooled positive carbon with magazine feed, an uninterrupted light of 150,000 cp is possible for periods up to two days.

Electric Braking of Induction Motors

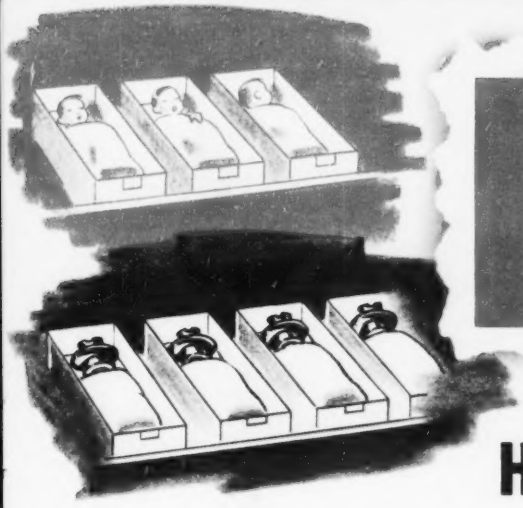
L. W. HERCHENROEDER
Industry Engineering Department
Westinghouse Electric Corp
East Pittsburgh, Pa.

OVER its speed range, the induction motor has braking characteristics more than it has motoring characteristics as shown in Fig 1 on page 127.

The more common electric braking methods for induction motors are plugging, regenerative braking, capacitor braking, and d-c dynamic braking. Special schemes of unbalancing the motor currents for braking torque, are not discussed. As shown in Fig 1, braking is obtained when the torque and speed are of opposite signs. Braking is thus obtained for all negative speeds and positive speeds greater than synchronous. Plugging is operation in the negative speed range, and regenerating is operation at a positive speed greater than synchronous. Plugging is widely used because of the simplicity of the control and the large amount of braking torque that is obtained. All that is required to plug a 3-ph motor is to reverse two of the three primary connections. Sometimes resistance is used in the primary circuit to limit the torque. Despite its simplicity, plugging has several serious disadvantages. One is that if power is not removed from the motor when it reaches zero speed, the motor will accelerate up to synchronous speed in the opposite direction, see Fig 1. Usually, the power is removed automatically by a zero-speed switch. A second disadvantage is the large amount of losses. Motor losses while plugging to a stop are approximately three times as great as the losses while accelerating the motor from zero to synchronous speed. But for many applications plugging is quite satisfactory.

Regenerative braking supplies high braking torque with relatively small losses in the motor. Power current is delivered to the line by the induc-

From a paper presented at the 1949 Westinghouse Machine Tool Forum, Buffalo, N. Y.



HI-TENSION NEWS Junior

How will they turn out?

When you look through the window of a Maternity Ward, "the little bundles" are pretty much alike to the casual observer. Yet one may be President and another the Nation's leading gangster by 1990.

In the "maternity ward," pintype insulators look pretty much alike, too. Fresh from factory production, all reputable makes are extremely uniform. Yet there is a definite difference in these various makes—your own experience with pintypes confirms this.

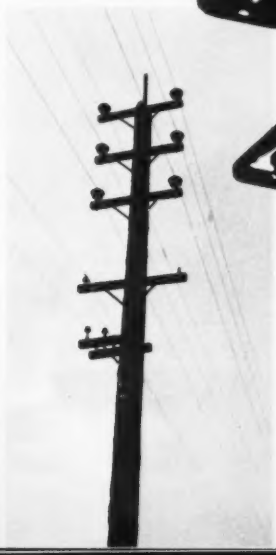
No test or no set of specifications applied to a new pintype insulator will give assurance of long future life. The slow progress of time, seasons, and exposure can't be speeded up in a laboratory. Until the day an insulator fails, its life is an unknown quantity.

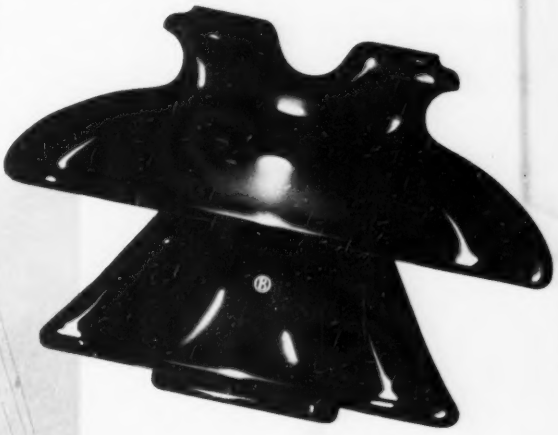
But there is at least one reliable measuring stick for this Number One requirement of a pintype insulator. Look around! Ask some questions! Demand some proof!

Only by chance may you run into the lines we show here, but there are hundreds more like them. Any O-B-insulated line will tell you the same story—for downright reliability, no pintype insulator has ever excelled O-B's. Many men use O-B's as a standard of comparison. Why take a chance when the standard, itself, costs no more?

32 YEARS

35 YEARS





Ohio Brass

MANSFIELD, OHIO, U. S. A.

IT WILL PAY TO LOOK AHEAD AT THE COST OF YOUR CITY PRIMARY DEADENDS

HI-TENSION NEWS *Junior*

City primary distribution voltages are being increased everywhere—2,300 volts will be the exception a few years hence. Many systems are making this increase by re-connection so as to retain the existing overhead equipment consisting of conductors, insulation, and transformers. One thing, however, that cannot be carried over from lower to higher voltage is the method of deadending.

If deadends are built, today, for 2,300-volt service only, they will probably have to be *re-built* a few years later. This rebuilding may be costly. Ignoring the probable loss from salvaging a surplus of still-useable but obsolete low voltage insulation, there are other factors such as doubling-up the work, plus the slow and somewhat dangerous operation of reconstruction in the areas of crowded pole tops.

Far-sighted management in the power industry is now turning to the practice of building all primary deadends for the inevitable voltage increase lying ahead. By doing this, the combined cost of labor and materials at these points may be cut in half. While remaining at the lower voltage, such deadends provide high safety factors and improved operation; and are ready to be cut over without further attention.

The practice for such deadends is clearly established — six-inch suspension insulator units, combined with suitable conductor clamps, which combine both high electrical and mechanical duties. When O-B materials are applied to this construction, you have the assurance of a suspension unit embodying all the durability which has been proved by well over 25 million O-B units now in service. O-B Universal Strain Clamps contribute their part to the combination by exerting a holding power, without slip, equal to at least 90 per cent of the cable's ultimate.

By building your city primary deadends—*from the start*—with these materials, you may cut your ultimate deadending costs in half!

MANSFIELD, OHIO, U. S. A.

HI-TENSION NEWS
Junior

OHIO BRASS COMPANY
BARBERTON DIVISION • BARBERTON, OHIO, U. S. A.

TO: ALLIS-CHALMERS

FOR: DUQUESNE LIGHT COMPANY

To meet growing industrial and residential demands of the Midland, Pennsylvania, district this new Allis-Chalmers transformer has recently been installed by the Duquesne Light Company. A-C points out a few of the distinguishing features of this unit—"Insulator strings deadend directly to the tank, thus eliminating overhead A-frame. Capacity 10,000 kva, with provision for a fan-cooled increase to 13,333 kva. High side, 66 kv delta; low side, 7 kv x 14 kv delta/12.1 kv x 24.2 kv Wye. Positive pressure inert gas oil preservation". . . .

AND BUSHINGS

ONE OF THE FINEST COMPONENTS OF ANY TRANSFORMER

Ohio Brass

MANSFIELD, OHIO, U. S. A.

2979

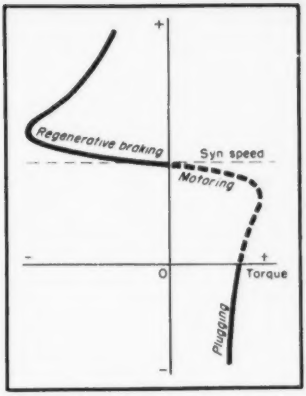


FIG 1—COMPARISON of motoring characteristic of an induction motor with that of plugging and regenerative braking

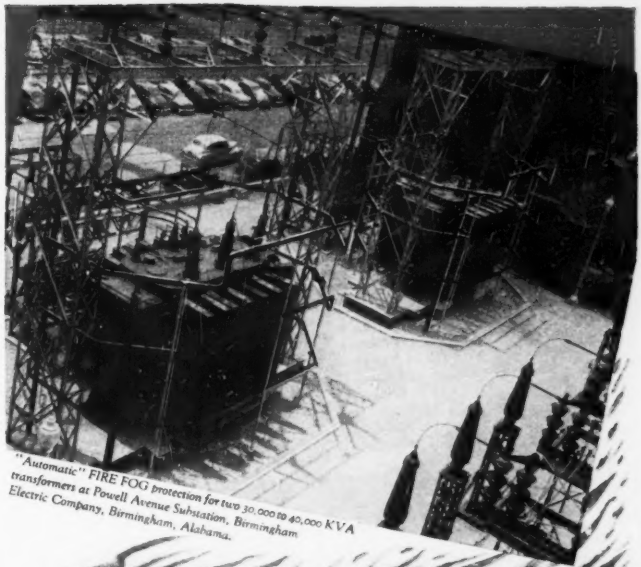
tion machine acting as an induction generator; excitation for the motor is supplied by the line. Regenerative braking cannot supply braking torque below synchronous speed. For the usual constant frequency power supply, regenerative braking for a single speed induction motor is commonly used for limiting the speed of overhauling loads. For multi-speed motors, often regenerative braking provides positive slowdown from high to low speed.

Capacitor Braking

Capacitor braking is a form of regenerative braking. If an induction motor is driven by some means and sufficient capacitance is connected across its terminals, it becomes a generator and can supply power to a load. The capacitors must supply the reactive power required by the induction motor and the load. Frequency of the voltage generated will be roughly proportional to the speed of the motor; but, there must be some slip so that the induction machine can supply power.

Capacitor braking is obtained by disconnecting the induction motor from the line and connecting capacitors across the motor terminals. Load resistors are sometimes connected across the motor terminals. Braking can be obtained by connecting capacitors across one, two or all three of the phases. Results are more consistent with the capacitors across two or three phases.

High torque can be obtained with capacitor braking with relatively small motor heating. As shown in


"Automatic" FIRE FOG protection for two 30,000 to 40,000 KVA transformers at Powell Avenue Substation, Birmingham Electric Company, Birmingham, Alabama.

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Only a hint of flame at this bank of high voltage transformers and—quick as a flash, *Automatic* FIRE-FOG goes into action. From strategically positioned nozzles, a concentration of fine water spray is directed at the blaze. Flames are forced down . . . the fire area cooled. In but a matter of seconds, extinguishment is complete and damage to equipment confined only to the point of fire origin. Even out-of-service time has been held to a minimum.

Automatic FIRE-FOG
IT BLANKETS - IT ISOLATES - IT QUENCHES

. . . a famous member of the *"Automatic" Sprinkler* Family . . . provides basic fire protection for process equipment and storage in the chemical and petroleum industries. On-the-spot protection for quench tanks, dryers, explosive hazards, conveyor openings, air filters, oil filled electrical equipment and other units vital to production line operations.

Although a relatively new development, *Automatic* FIRE-FOG is widely recognized by both utility companies and private users. Designed specifically for your particular risk it is electrically safe and carries the approval of all leading insurance authorities.

More detailed information, especially as to how *Automatic* FIRE-FOG can serve your needs is available upon request and surveys and estimates will be furnished without cost or obligation. Write today.

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the transformer of the future
ELECTRICAL WORLD
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FUTURE POSSIBILITIES
. . . It is to be expected that such activity (improvements) will continue in the future. Much of it can probably not be foreseen at this time. There are a few items, however, which might be mentioned as either distinct possibilities or highly desirable.
There is considerable promise of the production of a dry-type distribution transformer for pole top installation. The advantage will be less weight and lower maintenance. It seems possible that on such a transformer the case might be reduced to a minimum or perhaps be eliminated entirely.
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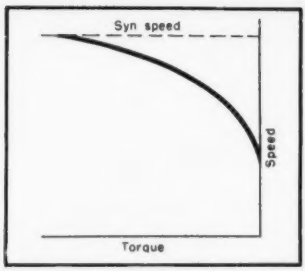

FIG 2—CAPACITOR braking characteristic of an induction motor

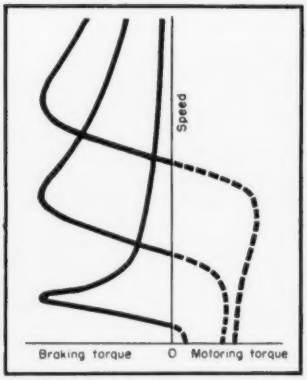

FIG 3—EFFECT of frequency on the characteristic of an induction motor

Fig 2 the torque obtained with any one value of capacitance drops off very rapidly with speed. This is because the generated voltage and frequency decrease with speed, and the capacitance required to fully excite the motor therefore increases as the speed decreases. Usually, capacitor braking torque is not effective below approximately one-third speed.

D-c dynamic braking is another form of regenerative braking. It can be considered to be the operation of an induction motor with zero frequency applied to the terminals. Regenerative braking for several values of frequency with the voltage adjusted to maintain the same maximum torque, is shown in Fig 3. With the frequency reduced to zero, or when d-c is applied to the stator, the braking characteristic is as shown in Fig 4 (top of page 130). High maximum torques can be obtained with d-c dynamic braking and with relatively little motor heating. The torque decreases rapidly at high speeds for motors of normal slip. Thus, for a quick stop it is necessary to use a

A total of 1100 square feet of corrugated white translucent PLEXIGLAS *covers the entire ceiling of the elevator foyer and entrance lobby of the Central National Bank, Cleveland, Ohio. Use of 47½" x 48" x .125" sheets of the acrylic plastic results in over-all, glare-free, completely diffused illumination.*

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Light the Whole Room Without Glare or Shadows

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At the same time, the lightness and shatter-resistance of PLEXIGLAS assure safety overhead. This acrylic plastic has 7 times the impact strength of glass, yet weighs less than half as much. Large, light sections can be installed easily at reasonable cost, and because PLEXIGLAS resists discoloration—even from fluorescent lighting—maintenance expense is low.

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More and more architects are using PLEXIGLAS fixtures for superior lighting, especially over large areas in offices and public buildings. Its availability in large sheet sizes, corrugated, patterned, or smooth-surfaced—and the ease with which it can be formed into shaped panels and fixtures—permit its use in highly distinctive functional and decorative lighting.

For wall-to-wall lighting fixtures, coffer panels, reflectors, shields, cove lighting fixtures—wherever optimum illumination with no direct or reflected glare is desired—get full details of PLEXIGLAS. We'll be glad to send you complete information.

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ROHM & HAAS COMPANY

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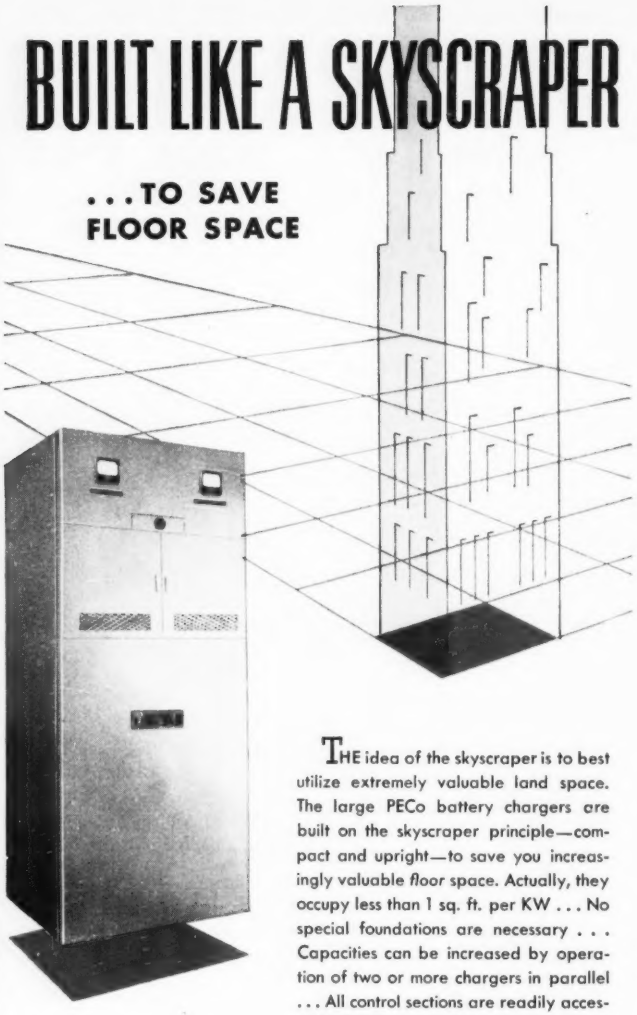
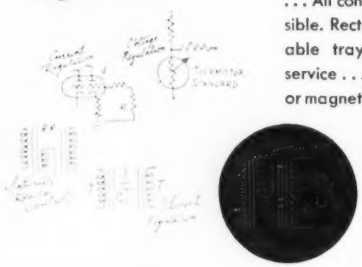
BUILT LIKE A SKYSCRAPER

. . . TO SAVE FLOOR SPACE



THE idea of the skyscraper is to best utilize extremely valuable land space. The large PECo battery chargers are built on the skyscraper principle—compact and upright—to save you increasingly valuable *floor* space. Actually, they occupy less than 1 sq. ft. per KW . . . No special foundations are necessary . . . Capacities can be increased by operation of two or more chargers in parallel . . . All control sections are readily accessible. Rectifier assemblies are on removable trays to facilitate inspection or service . . . Fully automatic; electronically or magnetically controlled and regulated; accurate floating voltage control within ±1% . . . Complete range of sizes up to 10 KW . . . Write for all the facts.



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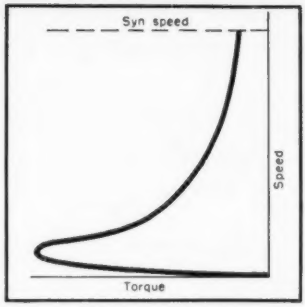

FIG 4—D-C dynamic braking characteristic of an induction motor

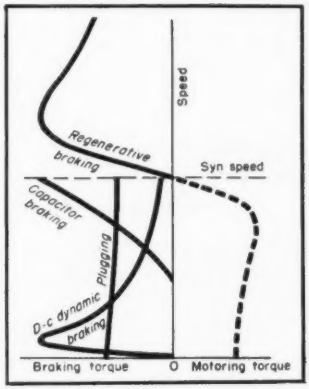

FIG 5—COMPARISON of common methods of electric braking of an induction motor

high d-c exciting current. The scheme has the advantage of providing braking torque down to zero speed without danger of the motor reversing. Often the source of d-c power is a metallic rectifier. A time delay relay usually removes the d-c excitation after the motor has stopped.

Characteristics of the different types of electrical braking are summarized in Fig 5. Plugging provides good braking torque down to zero speed, but the motor suffers high losses and will reverse if it is not disconnected from the line when it reaches zero speed. Regenerative braking provides good torque with low motor losses; but no braking torque is obtained below synchronous speed. Capacitor braking results in low motor losses; but torque falls off rapidly with speed and it is usually not practical to attempt to brake below one-third of synchronous speed. D-c dynamic braking has low motor loss; but torque decreases rapidly at high speed for motors of normal slip.

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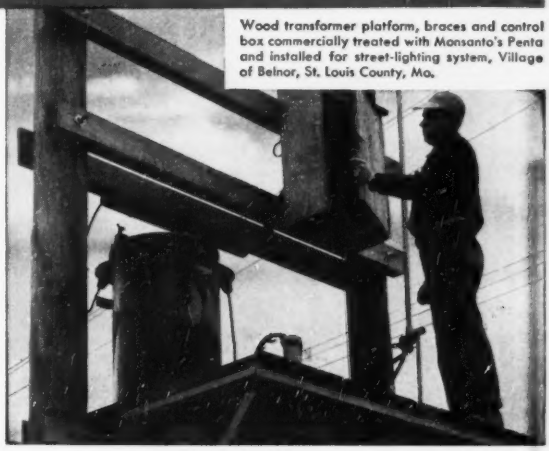
These rotten, unsafe wooden members were replaced with Monsanto Penta-treated material.



Wood transformer platform, braces and control box commercially treated with Monsanto's Penta and installed for street-lighting system, Village of Belnor, St. Louis County, Mo.

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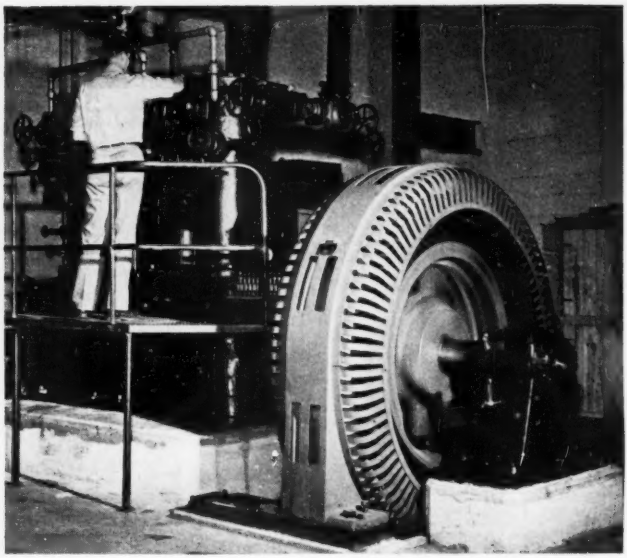
LOAD BUILDING

Little Oranges Demand Big Motors



THIS 800-hp synchronous motor and another of 400 hp drive ammonia compressors in production of frozen citrus juice concentrates. Magnetic starters eliminate voltage dips

V. R. PARRACK
Florida Power Corp
St. Petersburg, Fla.

RECENT INSTALLATION of an 800 and a 400-hp motor in the plant of Vacuum Foods, Inc, of Plymouth, Fla., is evidence of the rapidly growing production of canned frozen citrus juice concentrates. These synchronous motors drive ammonia compressors which produce 1,080 tons of refrigeration in a closed refrigeration cycle used in the concentrate process. The heat from the compressed ammonia indirectly vaporizes the orange juice and the refrigeration is used to condense the water evolved from the orange juice.

The two motors are rated at 2,300 v, 100% power factor, and are supplied from three 333-kva 4.8/8.32 Y-2.4-kv transformers. Manual semi-magnetic starters on 65% tap are used. No visible impression is made on the plant voltage either from starting or running as the compressors are of the 4-cyl type with $\frac{1}{3}$ and $\frac{2}{3}$ capacity reduction, thus producing running pulsations outside the critical frequency range.

Processing Operation

The oranges are trucked to the plant and conveyed to storage bins, thence they pass through a washing and grading process. They are then channeled past a small rip saw where they are sliced in half and dropped between two oppositely revolving drums which press out the juice. At this stage the juice contains from 11% to 13% solid material. The juice then passes through ten stages of concentrators which deliver the juice at 50% solid material and a temperature of approximately 65 F. At this point fresh juice is added for desired bouquet so that the product contains 42% solid material. It then undergoes a quick freeze to a mush consistency which brings the concentrate to a temperature of 15 to 18 F, and is flowed into 6 oz cans. The cans pass through a can closing machine; thence to a casing machine which packs 48 cans to a cardboard carton, and the cartons are then transferred to cold storage where a temperature of 10 F is maintained. From here they are shipped in refrigerated trucks or freight cars.

The Automatic Dishwasher — A New Load Building Appliance

J. C. SHARP
Vice President of Engineering
Hotpoint, Inc.,
Chicago, Ill.

STUDIES of electric appliances as load builders reveal that a typical all-electric home containing a water heater, dishwasher, range, automatic washing machine, clothes dryer, refrigerator, home freezer, ironer and disposal will use a total of 7,305 kwhr per year. The electric water heater is the top load builder, accounting for 3,600 kwhr of this total without benefit of the additional load created by an automatic clothes or dishwasher. The electric range, historically a strong load buildler, is second in line with 1,020 kwhr. The dishwasher is third with 975 kwhr of which 665 kwhr are required for additional hot water.

These figures are considered typical of the energy usage of the aver-

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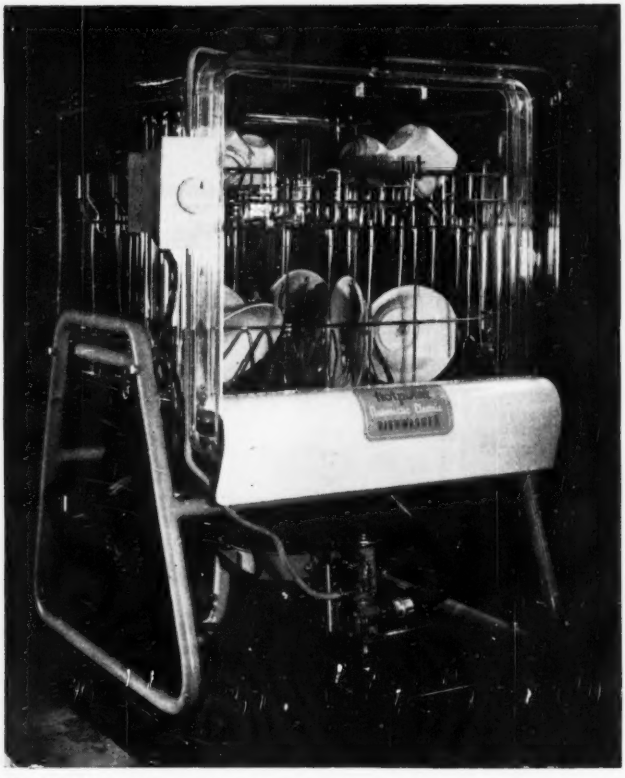


TO AID SALES, this engineer's model of an automatic dishwasher is fully enclosed in a plastic case so that washing, spraying and drying cycles can be observed

age family of four or five persons, and will vary according to geographical location and standards of living, as well as sizes or performance capacities of some appliances.

The best means of dramatizing the additional load that an automatic dishwasher contributes is to contrast automatic dishwashing with the manual method. The dishwasher motor and heater account for 310 kwhr per year, on the household general purpose rate. Additional water needed for this appliance requires an additional 665 kwhr on the water heater rate. Total kwhr increase through the use of the automatic dishwasher is 975.

Where a dishwasher is used with a gas water heater, the dishwasher will contribute an additional 310 kwhr while gas consumption for water heating will increase from 35.6 therms to 78.7 therms, or a total increase of 43.1 therms.

This illustration is based on studies which show that 6.0 gal of 150-degree water per day are used for hand dishwashing 340 days a year. Approximately 500 electric dishwashings per year are performed with an average of 9 gal of 150 F water per washing. One kwhr will deliver 3.7 gal of 150 F water, assuming the cold water supply is 50 F. The maximum 15-min demand for a single dishwasher is 935 w; 825 w for the heater, and 110 w for the lightly loaded motor during the drying cycle.

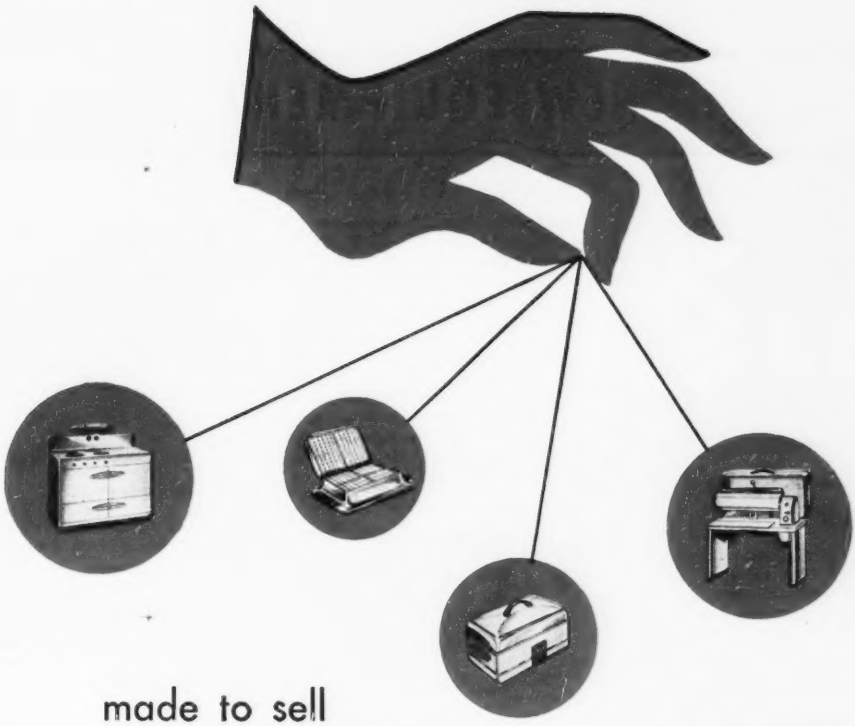
At first glance it might appear that despite the low cost of electricity, owning a dishwasher would be an appreciable expense for the average housewife. On the contrary, the following illustration shows that many customers, given the facts, can't afford to do without a device which efficiently washes and dries dishes at a cost of only a few cents.

Cost of washing dishes by hand is $2.28 a month when all contributing costs such as hot water, soap flakes, towels and hand lotion are considered. Hot water for the dishwasher used 101 kwhr per month at 1¢ per kwhr, representing a cost of $1.01 per month for hot water. Detergent costing approximately 25¢ a pound is used at the rate of 37 pounds a year, with a monthly cost of $.77. Operating cost of the dishwasher motor and heater is $.72 a month based on 500 washings a year, and the household electricity rate of 3¢ per kwhr. Total monthly dishwasher operating cost, thus, is $2.56 compared with $2.28 for manual dishwashing. However the Hotpoint dishwasher saves at least 50 min a day, or 25 hours a month. Cost per hour saved is slightly more than 1¢, or if depreciation is considered, the cost of owning and operating a dishwasher is 7.5¢ for each hour saved. Operating the dishwasher mechanism costs only slightly more than operating an electric refrigerator, it should be pointed out.

Relatively high installation cost is a problem that the electrical industry must work together to solve. Reviewing the contributions made by electric utilities in standardizing range and water heater installations, electric appliance manufacturers are vitally interested in the support that utilities can lend to this effort.

"Of Course—It's Electric"

THIS SIGN of the times, set to attract the motorist's eye, is proof of the trend, says Georgia Power's "Sales Log"



made to sell with **chromel***

*the original nickel-chromium heating element wire

That's right. Durable CHROMEL Resistor Wire has had a lot to do with building sales of electrical heating devices . . . a lot to do, too, with building and maintaining your domestic and industrial heating loads. For CHROMEL, you know, is the *original* nickel-chromium resistor wire . . . the wire that *first* made electrical heating practical. Complete technical information on the CHROMEL family of alloys is contained in our Catalog M1 . . . want a copy?

HOSKINS MANUFACTURING COMPANY

4445 LAWTON AVE. • DETROIT 8, MICHIGAN

NEW EQUIPMENT

Hot Line Clamp

FEATURING a heavy-duty, built-in, Vanadium steel spring which, according to the manufacturer, corrects for effects of fault currents, atmosphere changes, load variations, and the tendency of the conductor to "relax" or "flow", a hot line clamp is made by Fargo Mfg Co. Inc, Poughkeepsie, N. Y.

Designated as AGE-O, clamp will accommodate a No. 2 strand copper run wire and tap-off or will take No. 2 ACSR when in plated bronze, or cast aluminum. Manufacturer reports that clamp is adaptable to all hot line sticks.

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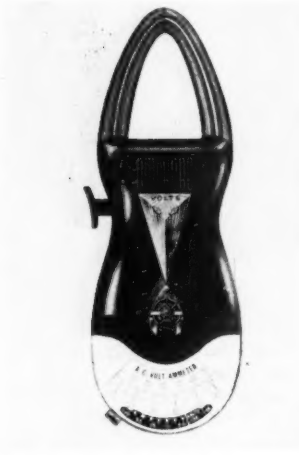

Split-Core V-A Meter

DESIGNED AS A pocket instrument for measuring current without service interruption, and also for measuring voltage, a split-core volt-ammeter is introduced by Pyramid Instrument Co, 49 Howard St, New York, N. Y. Known as the Amprobe, the instrument is 7⅛ in. long, 2 9/16 in. wide and 1⅛ in. high and weighs 12 ounces.

It is available in two models—Model A-5 has 6.5/13/26/65/130-amp and 130/260-v scales; Model A-6 has 10/25/50/198/250-amp and 150/600-v scales. Case and scale window are molded as one piece in impact-proof lucite plastic. The edge lighted window permits shadowless, wide angle vision of the 2.47-in. scale.

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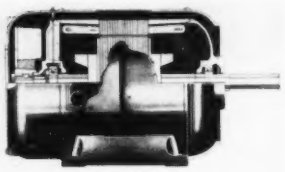


Totally Enclosed Motor

DESIGNED TO PREVENT any foreign matter from pentrating the windings, a totally enclosed, fan cooled motor has been announced by Valley Electric Corp, Dept 114, 4221 Forest Park Blvd, St. Louis 8, Mo. Known as type TEFC, this air cooled ball bearing motor is produced in sizes of 2 to 60 hp.

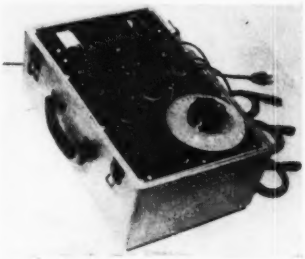
Motor is polyphase, 50/60 cycle, constant speed, continuous duty, squirrel cage induction with high torque and low starting current. Temperature rise on stator windings will not exceed 55 C.

•

Non-Metallic Cable

DEVELOPED FOR interior wiring of farm buildings having ammonia fumes and other corrosive elements, RoBarn, a non-metallic sheathed cable, has been announced by Rome Cable Corp, Rome, N. Y. Neoprene sheath is claimed to protect cable against moisture, acids, alkalies, oxidation and flame.

Individual conductors are also protected by Neoprene cover. Between the assembled conductors and outer sheath is a closely woven glass braid for increased strength and flame resistance. Available in No. 14, 12 and 10 AWG, two and three-conductor, cable carries Underwriters' Laboratories label.



Resistohmeter

FOR MEASURING resistance and insulation resistance in both low and extremely high ranges, an electronic resistohmeter has been announced by Crown Industrial Products Co, 1327 W. 69th St, Chicago, Ill. Unit is a Wheatstone bridge which uses a 6E5 electron ray tube as an indicator.

Unit has range from 1,000 ohms to 100,000 megohms. Instrument provides test voltages of 10, 100 and 500 v d-c, and operates from a 115-v 60-cycle supply.

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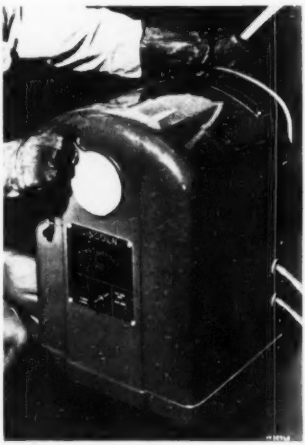


Portable Welder

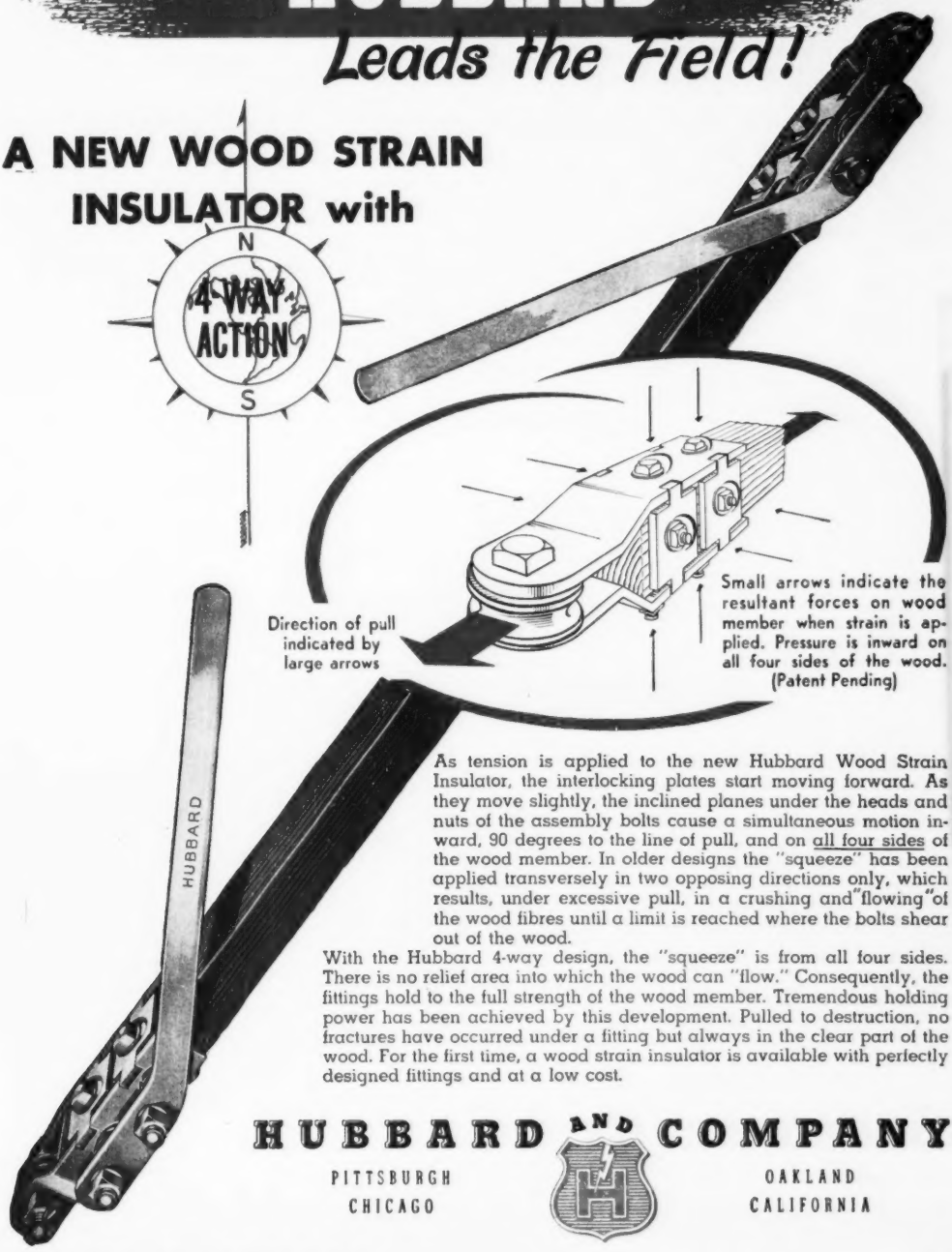
FOR USE IN both shop and industrial welder, a 200-amp a-c welder is announced by Lincoln Electric Co, Cleveland 1, Ohio. Known as the Fleetwelder 200, it is claimed to have

Once Again

HUBBARD

Leads the Field!

A NEW WOOD STRAIN INSULATOR with



Direction of pull indicated by large arrows

Small arrows indicate the resultant forces on wood member when strain is applied. Pressure is inward on all four sides of the wood. (Patent Pending)

As tension is applied to the new Hubbard Wood Strain Insulator, the interlocking plates start moving forward. As they move slightly, the inclined planes under the heads and nuts of the assembly bolts cause a simultaneous motion inward, 90 degrees to the line of pull, and on all four sides of the wood member. In older designs the "squeeze" has been applied transversely in two opposing directions only, which results, under excessive pull, in a crushing and "flowing" of the wood fibres until a limit is reached where the bolts shear out of the wood.

With the Hubbard 4-way design, the "squeeze" is from all four sides. There is no relief area into which the wood can "flow." Consequently, the fittings hold to the full strength of the wood member. Tremendous holding power has been achieved by this development. Pulled to destruction, no fractures have occurred under a fitting but always in the clear part of the wood. For the first time, a wood strain insulator is available with perfectly designed fittings and at a low cost.

HUBBARD AND COMPANY

PITTSBURGH
CHICAGO

OAKLAND
CALIFORNIA

for high-frequency electrical splices

ONE all-purpose material!

- **Dielectric Strength:** Over 10,000 volts (9 mils thick)
- **Insulation Resistance:** Greater than 8 x 10^6 megohms conditioned 24 hrs. @ 27° C — 70% R.H.
- **Dielectric Constant:** 2.6
- **Power Factor:** .0050 (10^6 cycles)
- **Corrosion Resistance:** No measurable corrosion effect
- **Solvent Resistance:** No known solvent for No. 822's backing at normal operating temperatures
- **Water Vapor Transmission Rate:** 0.24 gms per 100 sq. in. in 24 hours continuous immersion
- **Corona Quenching Characteristics:** Exceptional

POLYKEN*

ELECTRICAL ADHESIVE TAPE #822

AT LAST one simple, all-purpose tape replaces the many expensive, time-consuming packs, wraps and dielectrics considered necessary for primary splices of high-frequency apparatus. It's POLYKEN . . . amazing new Bauer & Black Tape. Made of polyethylene, it's an oriented plastic film, backed with a pressure-sensitive adhesive. Tensile strength is 22 lbs.

APPLIED QUICKLY, easily, it saves space . . . cuts splicing time dramatically . . . saves countless man-hours. Thin, yes. But tremendously strong. Resists aging and corrosion indefinitely. Truly an important advance in electrical materials! Try it! Write today for jobber in your area. Polyken, Dept. 5-9, 2500 S. Dearborn St., Chicago 16, Ill.

A product of

*Reg. U. S. Pat. Off.

BAUER & BLACK

Division of The Kendall Company, 2500 S. Dearborn St., Chicago 16

Industrial Adhesive Tape

PRESSURE SENSITIVE

Production Short Cuts to Reduce Costs • Research to Speed and Improve Methods

reserve capacity over its rated maximum load of 250 amp.

Welder will take electrodes ranging from 5/64 in. to ¼ in. in diam. Case is 25 in. high; made of pressed steel. Copper windings are insulated with spun glass and mica separators, placed in a welded steel laminated frame.

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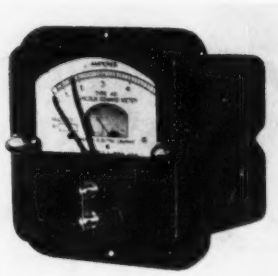

Demand Meter

FOR SEMI-FLUSH MOUNTING on power switchboards, a thermal ampere demand meter has been announced by Sangamo Electric Co., Springfield, Ill. Lincoln Type AD-2 meters have two demand indicating pointers.

Mounting flange on base permits fastening directly to switchboard panel. Cover is readily removed for access to meter element. Meters are supplied with either 3, 5 or 6-amp full scale ratings, and impose very small non-inductive burden. Dials reading directly in transformer and primary amperes are available.

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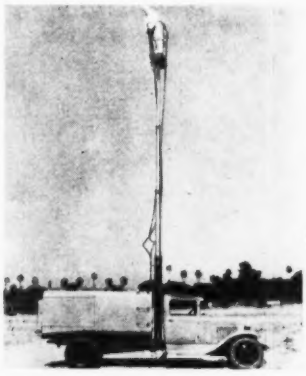
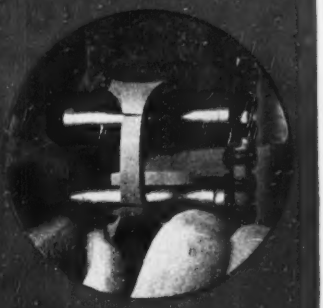


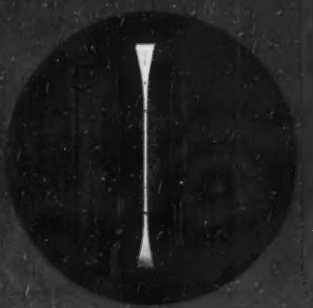
Extending Tower

FOR USE BY power companies, industrial plants and maintenance crews, a portable extending tower has been announced by General Machine & Weld-

SILASTIC* 250

THE TOUGHEST, MOST STABLE SILICONE RUBBER EVER MADE





FROM 500° F. TO -130° F.

Over a temperature span of 630° F., Silastic 250 has:

GREATER TENSILE STRENGTH . . . PLUS GREATER TEAR RESISTANCE, GREATER ELONGATION, BETTER ELECTRICAL PROPERTIES THAN ANY OTHER RUBBER-LIKE MATERIAL

SILASTIC 250

WITH GREATLY IMPROVED MECHANICAL STRENGTH

- tensile strength times elongation is increased by a factor of 2 to 6
- tear resistance is increased by a factor of 3

IMPROVED DIELECTRIC PROPERTIES

- dielectric strength ..... 700-900 volts per mil
- dielectric constant
  - at 100 cycles per second 3.1
  - at 1,000,000 cycles per second 3.0
- power factor
  - at 100 cycles per second 0.2%
  - at 1,000,000 cycles per second 0.8%

PLUS LOWER COST

- specific gravity of only 1.1 to 1.3 gives you 25 to 75% more parts per pound of stock.

OPENS UP THOUSANDS OF NEW APPLICATIONS

- in the aircraft industry, automotive industry, process industry, electrical and electromotive industries.

Wherever good mechanical strength and good dielectric properties are required at temperatures far above and below the limits of any other rubber-like material.

*Trademark registered U. S. Patent Office

Call our nearest branch office or write for data sheet PP 4

ATLANTA
CHICAGO
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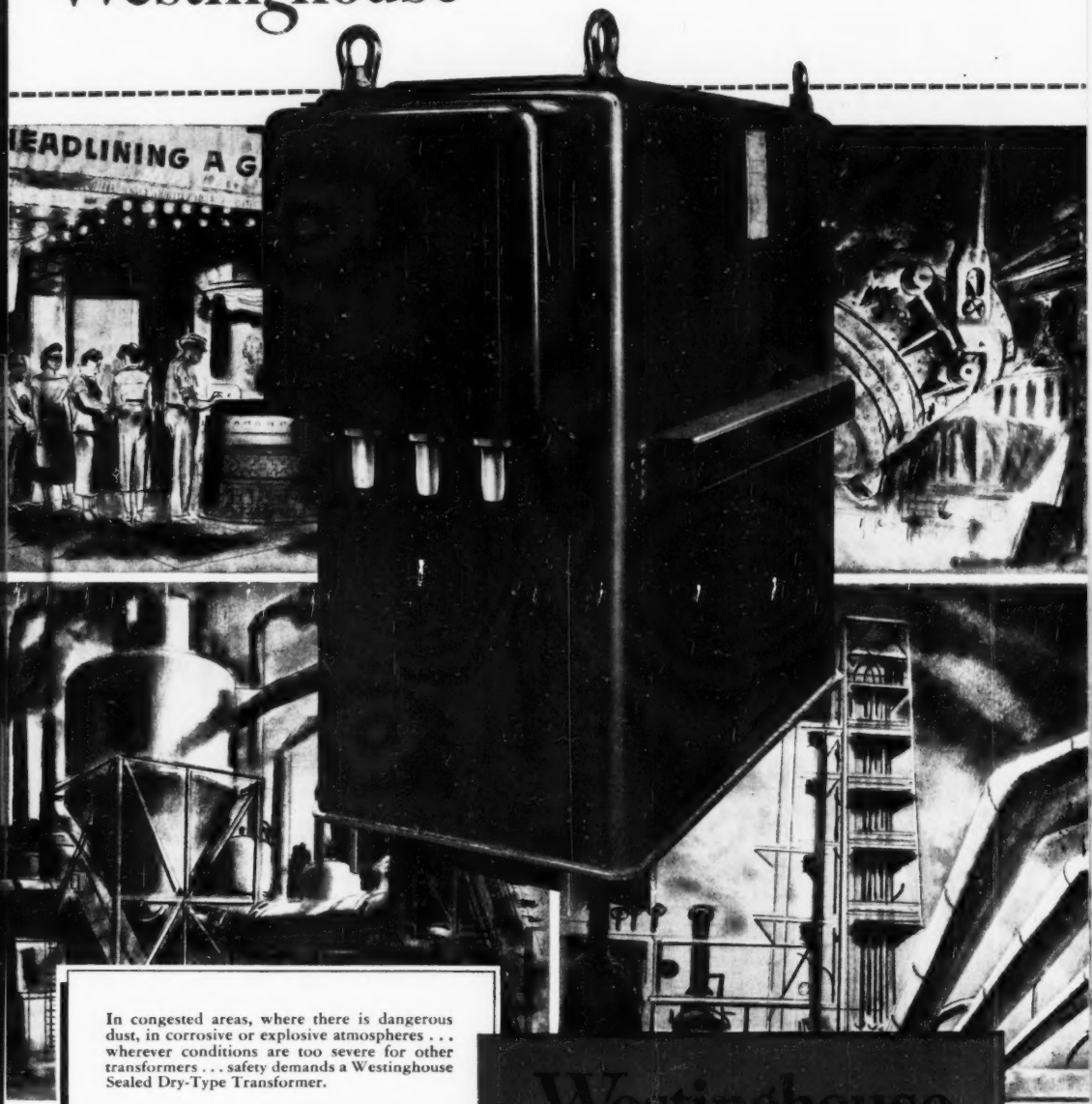
NEW YORK
IN CANADA: Fiberglas Canada, Ltd., Toronto
IN ENGLAND: Albright and Wilson, Ltd., London

DOW CORNING CORPORATION • MIDLAND, MICHIGAN

Dow Corning
FIRST IN SILICONES

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



In congested areas, where there is dangerous dust, in corrosive or explosive atmospheres . . . wherever conditions are too severe for other transformers . . . safety demands a Westinghouse Sealed Dry-Type Transformer.

Westinghouse

SEALED DRY-TYPE TRANSFORMERS

Safest Transformer Ever Built and it *Saves Money*, too!

Safe against fire and explosion hazards! Safe against submersion or hazardous dusts.

The Westinghouse Sealed Dry-Type Transformer is constructed with Class H insulation. Insulating materials consist of glass tubes and barriers, porcelain spacers, Fiberglas* and silicone varnish . . . in an atmosphere of dry nitrogen.

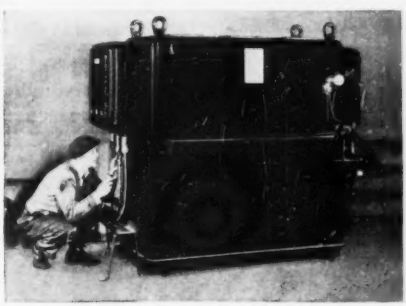
It Saves Money Three Ways

1. **No Vault to Build.** Because of its safety features, the Westinghouse Sealed Dry-Type Transformer may be installed anywhere without a vault or protective barriers. Reduces installation costs; minimizes maintenance time.
2. **No Liquids.** No storing, testing, filtering or reconditioning. No seepage or smudge.
3. **No Accessories for Liquids.** Devices such as valves, cooling units and gauges are eliminated, effecting economy in space and maintenance, improving appearance.

*T. M. Reg. O-C-F Corp.

For complete reliability, economy and cleanliness—*greater safety at greater savings*—install Westinghouse Sealed Dry-Type Transformers. Get an unbiased recommendation from the man who sells all types of transformers, your Westinghouse representative. Or write Westinghouse Electric Corp., Transformer Division, Sharon, Pa.

J-70546



A recent sealed dry-type installation of a network transformer in the basement of a large theatre in Pittsburgh. Westinghouse's first Sealed Dry-Type Transformer has been in successful operation since 1943 in New York City.

NEW GUTH MAZELITE*

hook-on reflector.....

and those Turret Sockets are dandies, too!

That rugged reflector can take it because its GUTH 300° WHITE PERMALUX finish is high-baked to bonderized, zinc-coated steel—*can't* crack, check, chip, craze or peel. Gives over 85% light reflectivity, too!

No more tugs-o'-war trying to remove stubborn reflectors for cleaning! No nuts, clips or gimmicks to get lost or out of order! Mazelite hook-on Reflectors hinge from either side of channel or can be completely removed and replaced instantly.

The new MAZELITE's TURRET SOCKETS speed relampings. Lamps cannot work loose. We'll gladly send you our handy new Pocket Catalog 46A-H with full details about this and other outstanding lighting equipment—compliments of

YOUR TEAMMATE IN *precision-planned* LIGHTING

Guth LIGHTING

*®

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902

013

ing Works, 1100 E. Second St, Pomona, Calif. The Miller tower is hydraulically powered by oil or water and is built to extend as high as 60 ft.

Five stages, or less, is standard and each stage can range from 5 to 9 ft. Towers are operated by hand valves either from catwalk at top of rig or from controls by driver's seat and can be stopped, raised or lowered at any point. They are designed to fit any truck chassis.

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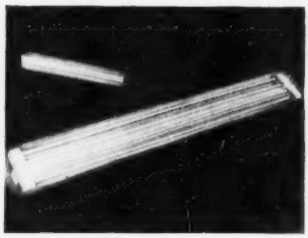


Cold Cathode Lamp

FOR COMMERCIAL and industrial use in a specially designed fixture, a cold cathode lamp has been developed by Cutler Light Mfg Co. 2026 N. 22nd St, Philadelphia, Pa. The lamp is said to have all the advantages of custom-built cold cathode including life of 20,000 hr.

The fixture has a steel body finished in white baked enamel and a HPF brick type transformer concealed in the spine. Both lamp and fixture carry a one year guarantee. Fixture bears Underwriters' Laboratories seal.

•

Package Substations

FOR USE ON rural systems, a complete ready-to-install package substation is available from the Apparatus Dept. General Electric Co, Schenectady 5, N. Y. Substation is manufactured as a unit-fabricated steel structure; transformers, switchgear, lightning arrestors, all components, necessary hardware, erection diagrams and drawings are included.

Ratings range from 300 to 1500 kva. 22,000 to 69,000-v (incoming) and 12,470Y/7,200 or 13,200Y/7,620-v (outgoing). Building block design permits capacity to be added or removed in easily handled blocks of power. Request publication GEA-5276.

•

Tachometer

FOR CHECKING SPEED of rotating equipment, a miniature Frahm resonant-reed tachometer has been an-

We try to prevent wrong numbers, too!

A truck is a wrong number if it doesn't fit the job. It's a wrong number if it isn't rugged enough for the job. It's a wrong number if it can't be serviced the right way at the right time.

Here's what we do to make sure you don't get any wrong numbers when you buy International Trucks: We give you—

1. The right truck for the job: Whatever your utility job may be, International has a truck specialized to go right down the line with you. There are 22 basic International models, 1,000 truck combinations in International's complete truck line. These come as big or as small as you want 'em—with gross weight ratings ranging from 4,400 to 90,000 pounds.

2. The truck that's built right for the job: These "Standard of the Highway" trucks are built to more than meet exacting specifications for your exacting work. They have enough ruggedness in 'em to take routine work in stride, year in and year out. And they have extra ruggedness in reserve so they'll stand up when an emergency arises.

3. The right set-up for truck service: International puts a lot of stock in maintenance the same as you do. 4700 conveniently located Dealers and 170 company-owned Branches throughout the country make up America's largest exclusive truck service organization. It puts International precision-engineered parts and International factory-trained mechanics within easy reach of every International owner in the United States.

A service set-up like that, standing behind a complete, ruggedly built line of trucks, should be right down your alley. You can find out easily—just call your nearest International Dealer or Branch and ask him to lay the facts right on the line for you—soon!

International Harvester Builds McCormick Farm Equipment . . . Farmall Tractors . . . Industrial Power Motor Trucks . . . Refrigerators and Freezers

INTERNATIONAL TRUCKS

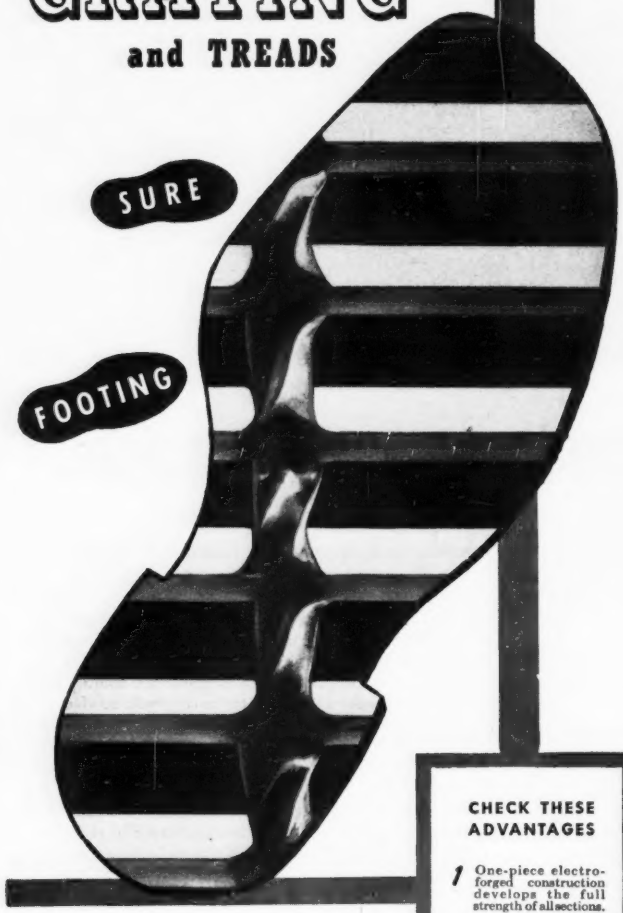
MOTOR TRUCK DIVISION • INTERNATIONAL HARVESTER COMPANY • CHICAGO

BLAW-KNOX

ELECTROFORGED

STEEL GRATING

and TREADS



CHECK THESE ADVANTAGES

1. One-piece electro-forged construction develops the full strength of all sections.
2. Maximum Open Area for light and ventilation.
3. Easy to Maintain . . . easy to paint thoroughly.
4. Self-Cleaning, no sharp angles to retain debris.
5. Safe footing at all times due to twisted cross bar.

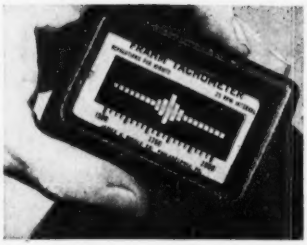
BLAW-KNOX DIVISION

OF BLAW-KNOX COMPANY

2013 Farmers Bank Bldg., Pittsburgh 22, Pa.

• • • •

. . . So that you can have a "close-up" of Blaw-Knox Grating construction, write for a paperweight-size sample on your letterhead.



nounced by James G. Biddle Co, 1316 Arch St, Philadelphia 7, Pa. Tachometer requires no contact with rotating element and imposes no load on machine under test. Company claims that tachometer cannot be injured by overspeeding and requires no maintenance.

It measures vpm as well as rpm and is available in ranges between 1,000 and 13,000 rpm. Cases are available to accommodate one or three instruments, or 60 or 90-deg brackets for permanent mounting. Additional information is found in Bulletin 31-35.

•

Metal-Clad Switchgear

FOR PROVIDING better protection against weather, improved ventilation, increased accessibility and greater safety to operating personnel, an outdoor type vertical-lift metal-clad switchgear has been announced by Allis-Chalmers Mfg Co, Milwaukee, Wis. Circuit breakers are withdrawn from the rear.

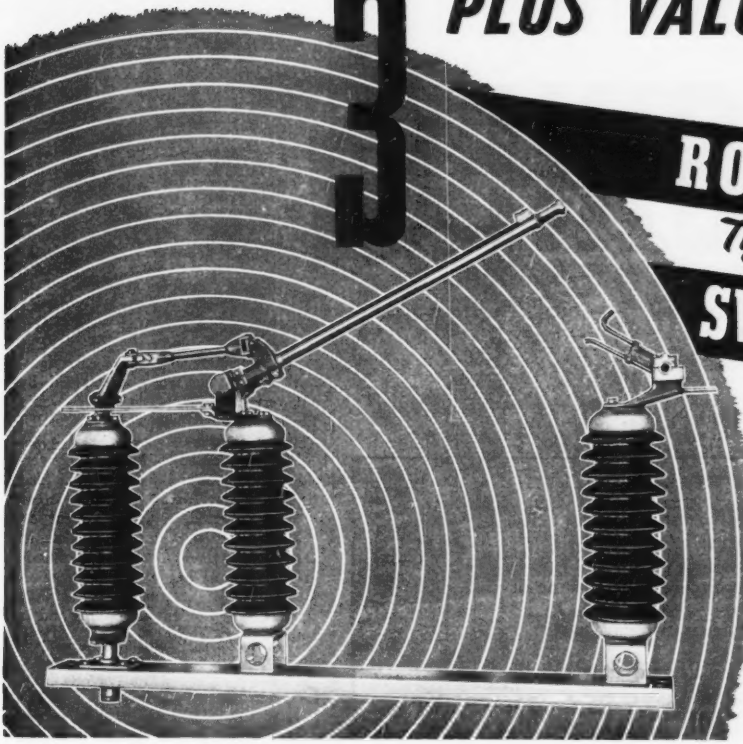
Air circuit breakers equipped with wheels eliminate special truck inside structure. Heating and lighting facilities are provided in each unit. Door handles can be padlocked and have ice and sleet shields for protecting locks.

•

Fluorescent Fixtures

FEATURING FOUR 40-w lamps for providing high intensities of illumination in high bay areas in commercial locations, the C-447 line of commercial

3 PLUS VALUES OF ROYAL Type VVL SWITCHES



1 SIMPLICITY OF DESIGN

2 HIGH PRESSURE POINT CONTACTS

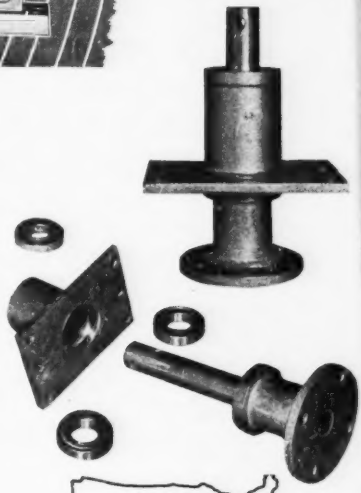
*3 SEALED BALL BEARINGS

*3. SEALED BALL BEARINGS:

The bearings under the rotating insulator and at the hinge end of Royal's type VVL switch are permanently sealed ball bearings packed in a special Silicone lubricant which stays fluid from sixty below to 150° F. This bearing was developed for the U. S. Army Air Force. It never requires adjustment, regardless of load. Dirt and corrosion are permanently sealed out. These bearings have a combined radial and thrust safety factor of four, based on the heaviest loads they were designed to carry. The bronze cover plates on the hinge bearings make firm electrical contact with the ends of the hinge pin, so that the bearing cannot carry current. We believe this is the easiest operating vertical break switch there is, and what's more it will stay that way. Touring the country in our display wagon, more than 4000 operations of the switch were logged by an electric counter. This is the equivalent to about 350 years of normal service, in addition to the severe punishment of 24000 miles of travel.

• The ROYAL Display Wagon will demonstrate this switch at your door. Watch for it! •

If you don't have our new Catalog No. 11, write for it today.



35 YEARS *A Part of the Arsenal of* AMERICAN POWER PRODUCTION

Royal ELECTRIC MANUFACTURING COMPANY INCORPORATED

1122 EAST 87th STREET Chicago 19, Ill.

Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

MOSINEE

"More than Paper"

If you have a fabricating or processing problem involving paper . . . if you require definite technical characteristics and, above all, *dependable uniformity*, it may be worthwhile for you and MOSINEE technicians to get together. MOSINEE is not interested so much in terms of volume production as in our ability to render helpful service to manufacturers in the field of electronics and in the electrical goods industry. Our "paperologists" are at your service for consultation. Please write Dept. EW.

MOSINEE PAPER MILLS COMPANY • MOSINEE, WIS.

Essential Paper Manufacturers

type, four-lamp, 40-w fluorescent lighting fixtures has been announced by Fluorescent Fixture Division, Sylvania Electric Products Inc, Salem, Mass.

Three fixtures comprise the new line —The unshielded C-447, the louver-shielded CL-447 and the plastic-shielded CP-447. Each may be surface or pendant-mounted, individually or in continuous rows. Fixture consists of aluminum enamel-finished basic chassis and reflector having minimum reflection factor of 86%. It is equipped with starters, lampholders and lamps and is Underwriters' approved.

•

Crane Hoist Control

FOR USE ON whirley, revolver, gantry and overhead cranes in steel mills, shipyards, warehouses, and on loading and unloading towers, a d-c crane hoist control has been announced by the Control Division, Apparatus Dept of General Electric Co, Schenectady 5, N. Y. This control is said to provide power hoisting and power dynamic lowering depending upon load requirements. When decelerating the speed is reduced automatically before the solenoid brake sets, thus minimizing mechanical brake maintenance and protecting both motors and hoist equipment from excessive wear and shock. A metal-clad enclosure protects the panel against dirt and dust. Bulletin GEA-2292B contains further news.

•

Bushings

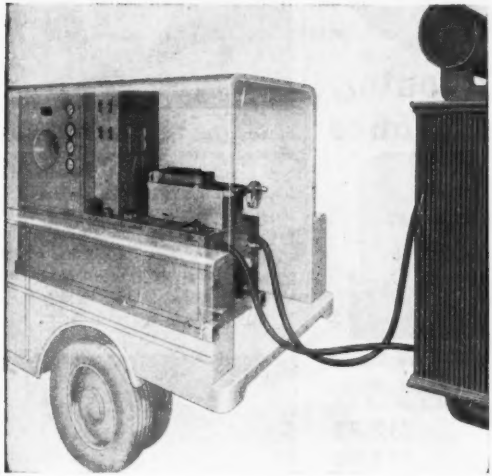
DESIGNED FOR USE on hermetically sealed transformers and condensers, a series of bushings has been announced by Heldor Bushing and Terminal Co, 60 Park Place, Newark 2, N. J. Bushings incorporate a neoprene rubber gland between two pieces of steatite and are installed by tightening a nut.

Bushings meet Govt Spec for hermetically sealed transformers and con-

BOWSER
ESTABLISHED 1885

OIL RECONDITIONING UNITS

. . . . for Transformers and Circuit Breakers



BOWSER HYDRO-VOLIFIER RESTORES OIL DIELECTRIC TO 35 K. V.

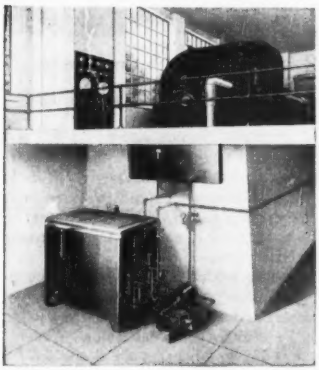
. . . in a *single pass!* It removes volatile corrosive acids, gases, dissolved moisture and solids—the enemies which promote sludge formation in insulating oils. Some users say that Hydro-Volified oil surpasses original insulating oil values and has greater stability.

NO SERVICE INTERRUPTIONS

This self-contained, exclusive Bowser process reconditions transformer oils WHILE ENERGIZED! Fewer "spare" transformers are needed—operating efficiencies are higher. One man with a truck-mounted Hydro-Volifier can efficiently serve widespread substation systems.

Capacities 100-300-500 GPH.

. . . . for Turbines to 110,000 K. W.



BOWSER TURBINE OIL RECONDITIONER DOES NOT DISTURB INHIBITORS

"Bone dry," crystal-clear oil from a Bowser oil reconditioner is the best stay-on-the-job insurance any turbine bearing can have. Inhibitors are not disturbed and there are no moving parts.

The process effectively removes deteriorating elements with . . .

- No Aeration
- No Turbulence
- No Heat
- No Catalysis
- No Water Contact with Moving Oil
- No Metal Contact

Bowser turbine oil reconditioners point the way to *longer bearing life* as the most direct approach to *lower operating costs.*

TO OPERATIONS MANAGEMENT

Bowser insulating oil and turbine oil reconditioners are effecting substantial reductions in operating costs in many plants. Less standby equipment is required.

If there's an "economy drive" on in your plant, you'll want complete details NOW! Bowser will help you work out a plan tailored to your needs. Write, wire or phone!

BOWSER, INC.
1384 Creighton Avenue
Fort Wayne 2, Indiana

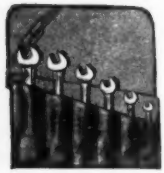
LIQUID CONTROL SPECIALISTS SINCE 1885

Snap-on

Open End Wrenches

with the famous "Blue-Point Supreme" Trade Mark

...are unequalled for strength, toughness and fatigue-resistance

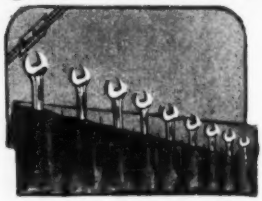


6-PC. Wrench Set

Twelve popular wrench sizes on 6 handles. Sizes from 3/8" to 15/16". No duplication of sizes.

In leatherette kit bag $8.50

Tools only $7.70

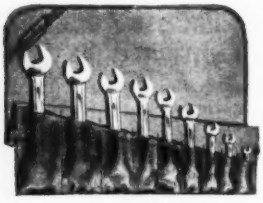


Sturdy 9-PC. Wrench Set

13 wrench sizes with 5 most popular sizes duplicated on different handles. Sizes from 3/8" to 1".

In leatherette kit bag $12.75

Tools only $11.10

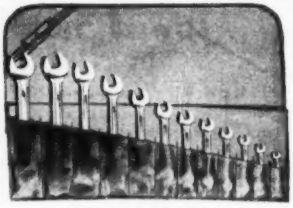


Popular 9-PC. Wrench Set

Here is one of Snap-on's most popular Open End Wrench Kits. There are 18 different wrench sizes that range from 1/4" to 1-1/4".

In leatherette kit bag $16.15

Tools only $14.50



Complete 12-PC. Wrench Set

Full range of sizes from 1/4" to 1-1/8" with 7 most used wrench sizes duplicated on different handles.

In leatherette kit bag $17.00

Tools only $15.35

Snap-on Tools
THE CHOICE OF BETTER MECHANICS

Snap-on Tools can be bought only from Snap-on branch sales offices and field men or Direct-by-Mail.

MAIL THIS COUPON TODAY!

SNAP-ON TOOLS CORPORATION
8108-H 28th Ave., Kenosha, Wisconsin

Enclosed find ( ) Check ( ) Money Order or ( ) Company Purchase Order for the Open End Wrench Kit checked below.

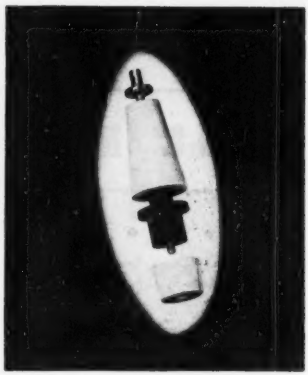
☐ $17.00 ☐ $16.15 ☐ $12.75 ☐ $8.50
☐ $15.35 ☐ $14.50 ☐ $11.10 ☐ $7.70

PLUS additional correct amount for Tax on Sales if required by your State or City

Name_____

Address_____

City_____ State_____



densers (Jan T-27, Jan C-25) and are claimed to resist oil and pitch, defy high heat, have high dielectric strength, low power loss and high resistance to physical and thermal shock. Twenty-five sizes and designs are available with resistance ratings from 2,000 to 60,000 test v. Mounting hole requirements range from 0.175 in. to 1.75 in.

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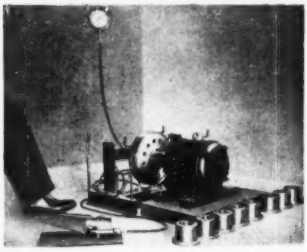


Hydraulic Dynamometer

FOR LOAD TESTING motors having shaft diameters up to and including 1-in, hydraulic dynamometer SA-483 has been announced by Wagner Electric Corp, 6400 Plymouth Ave, St. Louis 14, Mo. Also announced was hydraulic dynamometer SA-484 (illustrated) of 30 to 300 ft-lb capacity for load testing large motors.

This model is placed directly on the test floor and is provided with jack screws for raising it to correct height for connection to the motor. Adapters for 1¾ to 2⅞-in. motor shafts are furnished with dynamometer. Tests that can be made include idle, pull-in, pull-up, full-load and locked.

•

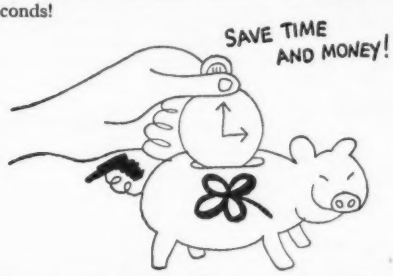
Field Service Unit

SERVICING OF construction equipment or other machinery distant from service centers can be done with mobile field service unit Type PW-308, produced by

Insist on stability...
...insist on OZALID!

When you duplicate with Ozalid, you save precious time and expensive labor.

For Ozalid copies anything written, drawn, typed, or printed on translucent material in as little as 25 seconds!



When you duplicate on Ozalid, *you save still more time and labor!* You needn't waste time "learning" the characteristics of each new batch of sensitized material.

Because rigid laboratory control insures that each shipment of Ozalid material will give the same performance as the last shipment and the shipment before that.

Month after month, shipment after shipment, you'll find this constancy in speed, in density, and in color. You'll find excellent fade-resistance. Physical strength, storage life, dye density, and ease of development are kept in scrupulous balance.

Another Ozalid Advantage is the nationwide service organization at the other end of your telephone. These technically trained business wizards will keep your Ozalid operation at top efficiency, will help you work out new methods of getting more done with less work... through Ozalid!

If you don't know what the above is all about ... you better hustle a letter requesting the full story of the newest business system, Ozalid. A FREE booklet explaining how error-proof Ozalid duplicates just about everything in seconds, is yours for the asking. If you're too busy to write, look in your classified telephone directory.

Don't copy...use
OZALID

Ozalid, Johnson City, N. Y. Dept. 85

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"From Research to Reality"

The man on the pole will tell you- KLEINS

Since 1857

If you know linemen, you know they want the finest in quality when it comes to equipment. Not only does their job depend on it—many times their lives do.

It is the reputation of nearly a century in designing and manufacturing the finest in linemen's equipment that has won Klein its position of preference with linemen and electricians everywhere.

It is easy to make equipment that looks like Kleins. It takes years of experience plus extensive manufacturing facilities to make equipment that performs like Kleins.

Today you are assured prompt delivery on all Klein products. Be sure your pliers, climber straps, safety belts and other items carry the Klein trade-mark—famous for quality "since 1857."

ASK YOUR SUPPLIER
Foreign Distributor:
International Standard Electric Corp., New York

The Klein Pocket Tool Guide showing the Klein line and containing useful tool information will be mailed on request.

Mathias KLEIN & Sons
Established 1857 **Chicago, Ill., U.S.A.**
3200 BELMONT AVENUE CHICAGO 18 ILLINOIS

Davey Compressor Co, Kent, Ohio. Equipment includes a 300-amp welder and 8-kw a-c generator driven from the truck engine.

Unit also has 150-lb lubrication system, oxy-acetylene welding equipment, 8-in. electric bench grinder, portable arbor press, floodlights and 7,500-lb winch. Waterproof body can be locked.

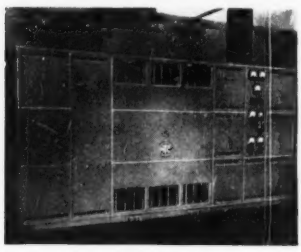
•

Fluorescent Luminaires

TWO LUMINAIRES for commercial lighting installations are announced by Curtis Lighting, Inc, 6135 W. 65th St, Chicago 38, Ill. Known as Challengers, these units direct 40% of the light upward, 60% downward.

They are made of steel, finished with high reflectance baked white enamel, and designed for use with two T-12, 48-in, 40-w fluorescent lamps, wired complete with high power factor two-lamp ballasts. Cat. No. 3525-CLH has 35-deg crosswise and 25-deg lengthwise shielding. Cat. No 3545 has 35-deg crosswise and 45-deg lengthwise shielding.

•



Unit Substation

FOR INSTALLATION in hospitals, schools, hotels and industry, a line of air cooled unit substations is announced by Marcus Transformer Co, Inc. 32-34 Montgomery St, Hillside 5, N. J. Complete power package consists of dry type transformer, primary protection, secondary breakers and metering units.

Transformer section is constructed throughout with Class B and C heat-proof insulation—fiberglas, mica, porcelain and Johns-Manville Quinterra. Units are available in sizes from 100 to 2000-kva inclusive, both single and three-phase up to 15,000 v.

13 ADVANTAGES of HARPER

NON-FERROUS AND STAINLESS STEEL
EVERLASTING FASTENINGS
over the lower first cost of common steel

1. Resistance to Rust and Corrosion
2. Resistance to High Temperatures
3. Non-Magnetic
4. Non-Sparking
5. Re-Usable
6. Attractive Appearance
7. Easy to Clean
8. High Strength
9. Long Life
10. Lower Ultimate Cost
11. Resistance to Fatigue
12. Easy to Plate or Finish
13. Resistance to Abrasion and Wear

OVER 6000 ITEMS IN STOCK

Write for complete, detailed 134-page Catalog

THE H. M. HARPER COMPANY

General Offices and Plant
Morton Grove, Illinois (Suburb of Chicago)
New York Office and Warehouse
200 Hudson Street, New York 13

Branch Offices: Atlanta, Cambridge, Cincinnati, Cleveland, Dallas, Denver, Detroit, Grand Rapids, Los Angeles, Milwaukee, Oakland, Philadelphia, Pittsburgh, St. Louis, Seattle, Toronto (Canada).

HARPER

EVERLASTING FASTENINGS

Has What It Takes

For Guys, Messenger and Overhead Ground Wire

EXPERT linemen know, when they use *Crapo* Galvanized Steel Strand, that it will meet every requirement the job demands. For *Crapo* Galvanized Strand "has what it takes" — *strength, ruggedness, workability, long-life.*

These essential characteristics, combined with ever important ECONOMY, make *Crapo* Galvanized Strand first choice for guys, messenger and overhead ground wire. The superior tensile strength of the steel is utilized to fullest advantage in each size and grade. The heavy, ductile, tightly-adherent galvanized coating — applied by the famous *Crapo* Process — provides dependable protection for the steel, prolongs the expectant life of the strand.

The all 'round reliability and overall economy of *Crapo* Galvanized Strand are matters of record with leading strand users. Such records contain ample and significant proof of the long life and low annual cost of this strand in service.

Available for Prompt Delivery

There is a size and grade of *Crapo* Galvanized Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you or write for further information!

INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

Crapo GALVANIZED STEEL STRAND

NEWS ABOUT PEOPLE

Pennsylvania Transformer Elects New Officers

Announcement has been made by the Pennsylvania Transformer Co, Pittsburgh, Pa., of the election of Samuel Horelick to the newly created position of chairman of the board and of W. E. Kerr to succeed him as president. W. R. Swoish, sales manager, was elected vice-president.

Mr Horelick has been president of

W. E. KERR

the company for the past 20 years. Mr Kerr has been vice-president and treasurer of the company since it was or-

W. R. SWOISH

ganized by him and Mr Horelick in 1929.

Mr Swoish has been sales manager of the company since 1944. He has had wide experience in the electrical industry. He was sales manager of both the distribution transformer section and the switchgear division at Westinghouse and was affiliated with the Roller-Smith Co as sales manager from 1939 to 1943. He spent a short time in the Cleveland office of Allis-Chalmers before joining Pennsylvania Transformer. Mr Swoish will continue as sales manager.

•

Philip H. Hardie and **Clarence P. Wilson** have become associated with Ebasco Services Incorporated as principal mechanical engineers. Mr Hardie has had wide experience in power plant design and engineering. He was associated for 15 years with Consolidated Edison Co of New York, and prior to that was with the Brooklyn Edison Co and Westinghouse Electric Corp. Mr Wilson is widely experienced in the industrial field. In his latest assignment before joining Ebasco, he was in complete charge of the design of power plants in Alaska. Prior to that connection, he was engaged in the design of power plants for textile and paper mills, oil refineries, and chemical plants.

NEW SALES MANAGERS were appointed by the A. B. Chance Co, Centralia, Mo., to direct sales of its three major product lines. They are (l to r): L. C. Hansen, who will direct sales in the field of anchors and pole line specialties; O. G. Anderson, hot line tools and conductor specialties; and L. R. Crane, switchgear and protective devices

A. B. Chance Co Appoints New Sales Managers

The A. B. Chance Co, Centralia, Mo., has appointed a manager of sales in charge of each of its three major product lines.

O. G. Anderson has been appointed manager of sales, hot line tools and conductor specialties; L. R. Crane, switchgear and protective devices; and L. C. Hansen, anchors and pole line specialties.

Mr Anderson has been Missouri Valley division sales manager for the company and chief hot line tool demonstrator. In this capacity he traveled the entire country, giving demonstrations and organizing training schools.

Mr Crane was formerly engineering specialist with the company. He joined the organization as a sales engineer in 1947. Prior to that time, he was application engineer with Westinghouse.

Formerly a transformer specialist with General Electric Co, Mr Hansen joined A. B. Chance in 1947 as a sales engineer. He will assume his new duties, in addition to his former ones as assistant to the sales manager.

There's always a night shift at the SORG printing plant . . . *just in case* copy comes in at night and proofs must be ready in the morning.

For this regular night shift there's no "overtime" charge . . . SORG SERVICE does *not* penalize a customer who *must* have his printing completed in the shortest possible time.

Every facility for handling financial printing is available in our own building for meeting deadlines with the utmost production accuracy and speed.

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SERVICE · QUALITY · THE SORG PRINTING CO. INC. N.Y. · RELIABILITY

Chicago Associate
McCORMICK and HENDERSON, Inc.

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The LEAGRAVE PRESS Ltd.

no time waste with FRANKEL "bugs"

• listed by underwriters

Accommodates a Broad Range of Cable Sizes Gets the Job Done Faster . . . Easier!

Frankel Split Bolt Connectors are easy to use on all types of connections, whether temporary or permanent. A proven favorite for taps, dead ends, motor leads, and in junction boxes, etc. For working in close quarters or mean spots, you can't find a better connector than a Frankel "Bug."

• *compare these advantages!*

1. Extra length pressure bar extending beyond nut, keeps threads firmly meshed, prevents stripping.
2. Extra wide wrench grip on body.
3. No sharp edges to nick wires.
4. All material guaranteed against season cracking.
5. Nut of high strength Duronze.
6. Pressure Bar is a bronze forging.
7. Body is 90% copper (comml. bronze).

•

Write today for Catalog 4B
SOLD THROUGH LEADING WHOLESALERS EXCLUSIVELY

KEEP FRANKEL "BUGS" HANDY — YOU'LL USE THEM EVERY DAY

Frankel Solderless Connectors

FRANKEL CONNECTOR CO.

27 VESTRY ST. • NEW YORK 13, N. Y.

42 YEARS OF KNOW-HOW IN SOLDERLESS CONNECTORS

Atkinson Directs Shasta and Keswick Operations

George D. Atkinson, electrical engineer at Shasta Dam, has been named superintendent of operations of Shasta

GEORGE D. ATKINSON

Dam and power plant and of Keswick Dam and power plant. These major features of the Central Valley project are located near Redding, Calif.

Mr Atkinson was first employed by the Bureau of Reclamation on the Boulder Canyon Project in 1930. He also has held engineering positions with the Southern California Edison Co, the Federal Power Commission, and the U. S. Army Engineers. During war years, from 1942-1946, he was on assignments in the South Pacific.

For the past two years he has been in direct charge of installation of electrical equipment at Shasta and Keswick power plants.

•

Robert H. Nye has been promoted to the post of assistant to the general sales manager, Western Massachusetts Electric Co. His headquarters will be at Springfield. He joined the sales department in 1937 at Greenfield, working in the commercial and industrial lighting division. Following three years' war service in the U. S. Navy as a lieutenant, Mr Nye has been sales manager of the northern division, Greenfield.

Walter G. Barney has been appointed purchasing agent for the Kennecott Wire & Cable Co, Providence, R. I., to succeed **George F. Monahan**, retired after 50 years of service.

Thomas M. Cody has joined the National Carbon Co (Eastern) Limited in Singapore as a technical representative.

J. A. Lucas, Sr. engineer with the utilities department of Jacksonville, Fla., for more than 30 years, has been named by the City Commission to succeed **Ar-**

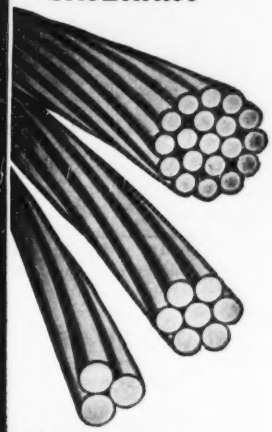
PAGE

Stainless Steel

STRAND

for

GROUND
GUY
MESSENGER
CATENARY



Higher

in Corrosion Resistance
Tensile Strength
Elastic Limit
Resistance to Vibration
Strength to Weight Ratio

Lower

in Cost per Year of Installed Life

Write us for literature or answers to specific engineering questions

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Pittsburgh, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

In Business for Your Safety

the SAVINGS in LOWER

Maintenance costs by using

YORK-HOOVER BODIES

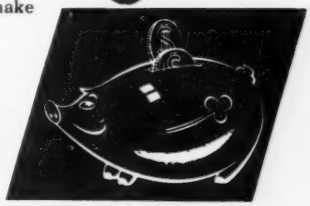
is just like

EXTRA MONEY in the BANK

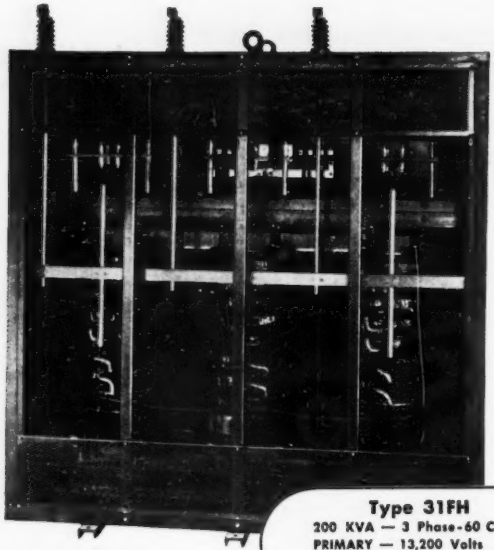
Model LCW-102

This light construction body is furnished with complete working equipment. Built in crew compartment provides maximum protection—adequate space is provided for all materials and tools—contributing factors which make the LCW-102 a profitable investment for you.

Write for the LCW-102 "facts" today!



YORK-HOOVER
YORK, BODY DIVISION PENNA
CORPORATION



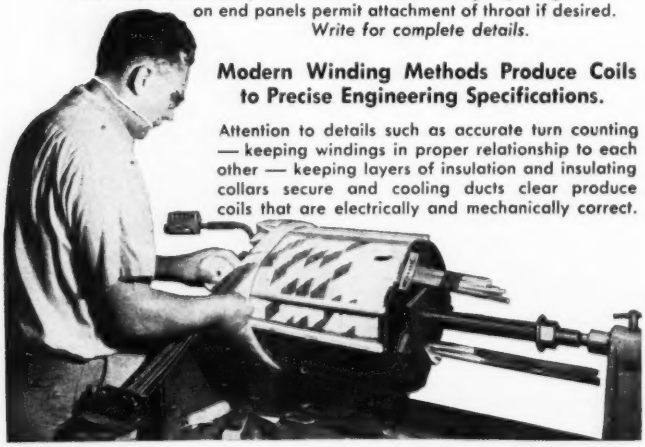
Type 31FH
200 KVA — 3 Phase-60 Cycle
PRIMARY — 13,200 Volts
SECONDARY — 240 x 480 V.
With 2 reduced Voltage Taps

Hevi Duty

TYPE 31FH **TRANSFORMERS**

reduce line voltage to desired operating voltage safely and economically at load centers.

These Hevi Duty Transformers have an unobstructed air chimney between high and low voltage windings which provides additional insulation between circuits and adequate cooling of coils.
Both front and back panels are removable. Large openings on end panels permit attachment of throat if desired.
Write for complete details.



Modern Winding Methods Produce Coils to Precise Engineering Specifications.

Attention to details such as accurate turn counting — keeping windings in proper relationship to each other — keeping layers of insulation and insulating collars secure and cooling ducts clear produce coils that are electrically and mechanically correct.

HEVI DUTY ELECTRIC COMPANY
HEAT TREATING FURNACES HEVI-DUTY ELECTRIC EXCLUSIVELY
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS
MILWAUKEE 1, WISCONSIN

mand R. Gouin as superintendent of the electrical production department. Mr Gouin retired on Aug 1. Mr Lucas has been acting superintendent.

•

Stark Made Sales Manager, of Photoswitch Inc

Announcement has been made of the appointment of Oscar C. Stark as general sales manager of Photoswitch Incorporated, Cambridge, Mass, with headquarters in New York.

OSCAR C. STARK

Mr Stark has been associated with the Square D Co, Detroit, in various sales and management capacities since 1930.

OBITUARY

Harry Slattery

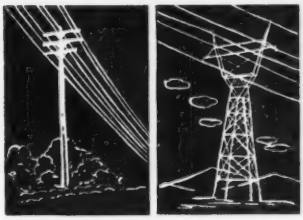
Harry Slattery, formerly administrator of the Rural Electrification Administration and Under-Secretary of the Interior from 1938 to 1939, died on Sept 1 at the age of 62. Since his resignation from REA in 1944, Mr Slattery had been practicing law in Washington.

Long an advocate of public power ownership, Mr Slattery was closely identified with the Norris-Ickes-Rankin "conservation of our natural resources" group, and, a staunch friend of Ickes, he served as his personal assistant from 1933.

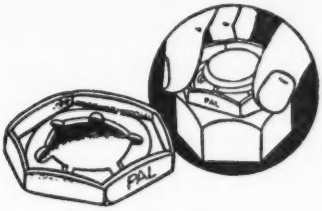
Mr Slattery received his education at Georgetown and George Washington Universities. In 1909 he became secretary to Gifford Pinchot, then head of the Forest Service. Organizing the Boulder Dam Association for construction of the project in 1925, he became general counsel and secretary, and while in that position wrote the Walsh resolution for investigation of public utilities by the Federal Trade Commission. He assisted in drafting the Federal Power Act of 1920.

ELIMINATE RE-TIGHTENING OF NUTS

On Steel Tower and Wood Pole Lines



Specify PALNUTS on new lines
Add PALNUTS to existing lines



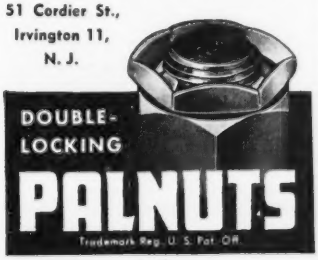
For over 10 years, Double Locking PALNUTS have been keeping bolt-and-nut assemblies tight on steel towers, wood pole lines, cross arms and braces, insulator pins, clevises and clamps.

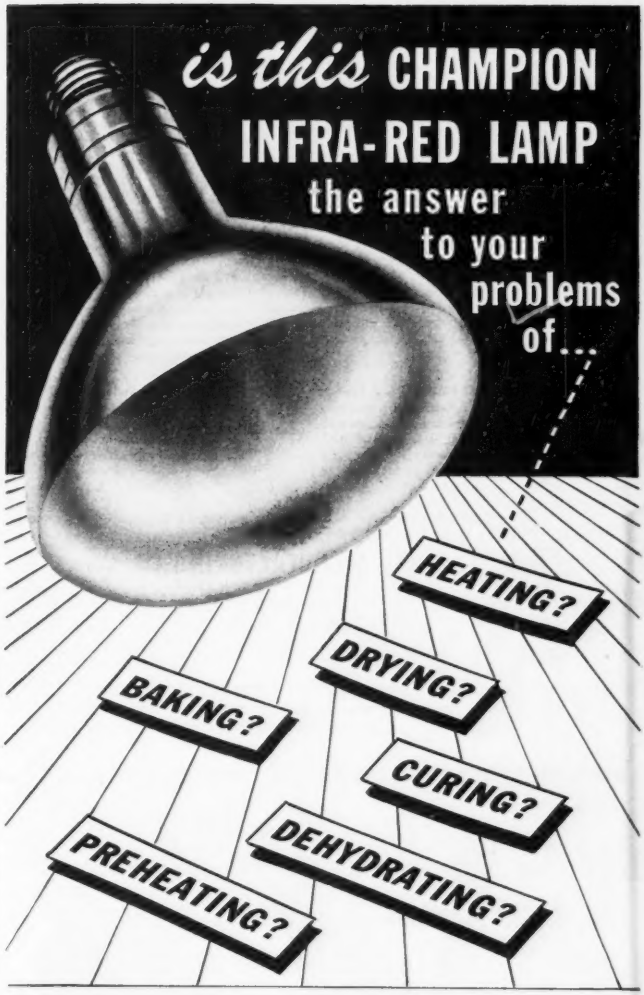
When applied on new installations, PALNUTS save future checkups and re-tightening. Maintenance crews checking old installations can add PALNUTS without disturbing regular nut. Only 3 bolt threads space are required. PALNUTS are very low in cost; may be removed and reused. They are available in a full range of sizes, in Hot Dipped Galvanized or other finishes and materials used by the Utility industry.

SEND details of your needs for samples. Write for PALNUT literature and detailed folder on power line applications.

THE PALNUT COMPANY

51 Cordier St., Irvington 11, N. J.



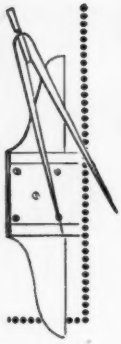


CHAMPION *Infra-Red* Lamps (250 watt and 375 watt) offer you potent advantages in the way of super-efficient radiant heat — fast, safe, flexible, clean, compact.

CHAMPION *Infra-Red* Lamps have *built-in* aluminized reflectors. Their special skirted screw bases are mechanically clamped to *stay put* regardless of heat intensity or length of duty.

For complete information on this remarkable lamp and how it can save space, time and money for you get in touch with the Champion industrial or electrical supplier in your town. He is backed by Champion's own field staff of trained lamp application experts, readily at hand and at your command. Or write to

CHAMPION LAMP WORKS
Lynn, Massachusetts



Designed to meet your needs...

TRAILERS

IN A WIDE RANGE OF SIZES AND TYPES

Combination Cable Reel and Pole Trailer — PCP & W-PCP Series: Quickly converted from cable reel to pole trailer — dual use provides low initial cost — only one trailer license needed.

P8T Series All Purpose Trailer: Combination cargo and pole trailer — new in design — versatile — many practical advantages. Front and rear bolsters, extension tongue, removable fenders and side boards, roomy cargo space.

1485-A Pole Trailer: Tubular-type tongue construction for strength with light weight. Rear bunk balances trailer and provides easy handling, when empty.

M Series Pole Trailer: 3 to 5 tons, exceptionally rugged. Heavy duty bearings permit dual tires. Extension tongue. Maximum safety, dependability, flexibility.

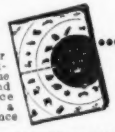
These trailers are representative of the wide line offered by FWD-Eagle — equipment engineered by and for utility men expressly for their needs.

EAGLE MANUFACTURING CO.

Division of the Four Wheel Drive Auto Co.

APPLETON
WISCONSIN

Write today for the complete catalog of FWD Line Construction and Maintenance Equipment — a useful reference book.



making sure with pounds not guesses...

Guesswork with high lines or guy wires is dangerous — unnecessary and most of all, costly. Summer slackness and winter tautness are unmerciful on your conductors — the "guess" method just isn't economical. Prevention of trouble is obtained only by strict adherence to the manufacturer's prescribed tensions for varying temperatures. Dillon Dynamometers were created specifically for this purpose. They are light-weight, portable and extremely accurate. Rugged — not injured by overload or hard knocks — shackle strength double Dynamometer capacity. Easy to use on pole or ground without cutting wire. Write today for your FREE copy of "Rules for Successful Wire Pre-Stretching and Stringing" — special bulletin on Dillon Dynamometer.

W. C. DILLON & CO., INC.

5410-C W. Harrison Street • Chicago 44, Illinois

Prior to the creation of REA, he was closely associated with Morris L. Cooke, who was then in the power division of the PWA and later became REA's first head. Mr Slattery served as chief of REA from 1939 until 1944.

Leo W. Barclay, 56, public relations director for the Los Angeles Department of Water and Power, died recently from complications arising from a throat operation last January. Mr Barclay headed the Water and Power Department's public relations department for the last four years and had been employed by the city-owned utility for 16 years. He went to California in 1922 to become identified with Goldwyn Pictures but resigned two years later to establish his own publicity and advertising business. Prior to 1922 he was engaged in newspaper work in the East for some years.

William Lloyd, widely known stoker designer and consultant on stoker engineering for Combustion Engineering-Superheater, Inc, died in New York on Aug 7, following a brief illness. He was 82 years old. Mr Lloyd was born in Wales and came to this country at an early age. In 1906 he became identified with the Lehigh Valley Coal Co where the Coxe traveling grate stoker had been under development by Eckley B. Coxe, who had died several years previous. Mr Lloyd redesigned the stoker in 1910. The Coxe Traveling Grate Co was organized in 1914, with Mr Lloyd as president, and when this company was purchased by Combustion Engineering in 1917, he continued with the latter.

Thompson W. Meriwether, Sr, assistant manager of the residential service department of the Memphis (Tenn.) Light, Gas & Water Division, died on Aug 16 following a heart attack. He was 62 years old.

W. Ray Stevens, formerly superintendent of the Richmond, Ind., municipal light plant, died on Aug 10 at the age of 57. Mr Stevens retired a year ago, after being with the municipal utility for 28 years.

Carl F. Walter, superintendent of the Cuyahoga Falls, Ohio, municipal light department and city electrical engineer, died on July 29 of a heart ailment. He was 52 years old.

John A. Riggins, attorney of Camden, N. J., and former president of the New Jersey Utilities Association, died on Aug 31, at Nantucket, Mass., where he was spending a vacation. He was 71 years old.

Hot idea for cooling off in Kansas

KANSAS summers are *hot*, as any Cornhusker knows; but one farmer figured a way to beat the heat! By pumping icy well-water into an old auto radiator and blowing air through it into his home, he found relief in a hurry! Another ingenious use for the greatest rural servant . . . electricity!

Wherever electricity spreads, you will find Hemingray Insulators, dependable always for efficient pole-line insulation.

No. 670 for 12,000-volt lines. The Technical Standards Committee of the Rural Electrification Administration has approved Hemingray Insulators No. 670, No. 680, and No. 514, under the limits of AIEE Specification No. 41-1944 for use on REA lines.

HEMINGRAY
POWER INSULATORS

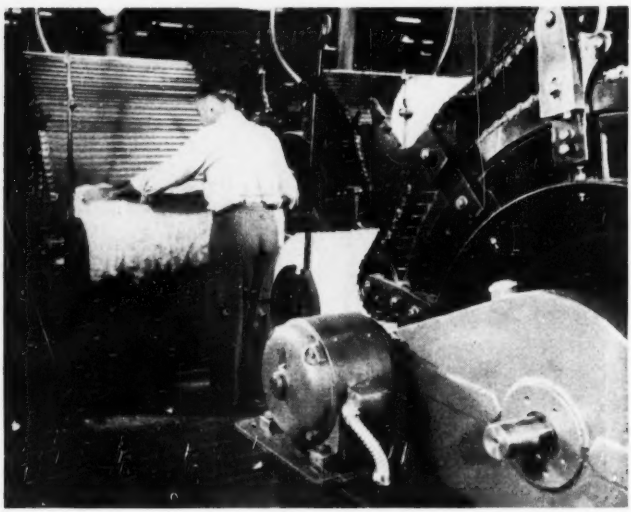
American Structural Products Company
Muncie Indiana
Subsidiary of Owens-Illinois Glass Company

Safety rules governing the use of dangerous equipment are in force in virtually all Industrial and Power Plants. Yet costly accidents frequently occur . . . because someone FORGOT!
So why not replace human frailty with mechanical infallibility? Install SUPERIOR INTERLOCKS.
These life and property saving Interlock units NEVER forget. They make untimely or unauthorized access to dangerous equipment IMPOSSIBLE. They keep such equipment, compartments or switches locked in use . . . or locked out of use . . . until the operator has opened other switches, closed doors, or in other ways complied with all of your safety regulations.
With SUPERIOR SAFETY INTERLOCKS you can INTERLOCK any number of points indoor or out, thus providing positive safeguards against accident. Write for full information. Let us engineers help solve your safety problem.

Authorized and Exclusive Service Representatives For The Bendix-Cory Interlock System

THE
SUPERIOR APPLIANCE COMPANY
73-39 CENTRAL AVE.
GLENDALE, BROOKLYN 27, N.Y.

MANUFACTURERS and MARKETS



INDIVIDUAL card drives help to boost production and to eliminate expense of maintaining belts and pulleys at a cotton mill—a scene from GE's movie, "Textiles Unlimited"

Electrification Program Set Up for Textile Mills

A textile mill modernization program, which seeks "increased and more refined electrification" in the textile industry as the key to lower costs, improved quality, and better working conditions has been announced by the General Electric Co.

Describing the objectives of the campaign, which is the thirteenth in the company's "More Power to America" series, Joseph W. Holt, of the GE manufacturing industries division, Schenectady, said "in the highly competitive textile industry, each industry group and each mill must strive to improve its economic standing.

"Segments of the market are constantly shifting, as between cotton, wool, and synthetics, and management must reckon with the effects of competition from foreign mills with their lower labor costs and increasing use of more modern equipment."

George W. Knapp, manager of the paper and textile division of the GE industrial engineering divisions, declared that maximum progress in textile mill modernization may be made through the cooperative efforts of mills, machinery builders, and electrical manufacturers.

Discussing engineering trends in the industry, Mr Knapp predicted that "we can look forward with certainty to continuing progress in the industry . . . with better quality and higher productivity for the benefit of all."

Describing the philosophies behind the "More Power to America" series, Fred W. McChesney, sales promotion supervisor for the company's industrial divisions, said that "new high levels of industrial production and efficiency must be effected if we are to preserve the high standards vital to American economy."

Mr McChesney asserted that "we must continue to apply more machinery and more electrical horsepower to still further increase the productive strength of the American workmen."

He said that the goals of the cooperative "More Power to America" program were determined by studies based on the kwhr of electricity used for each manhour employed. He pointed out that industry in 1929 was using 2.9 kwhr per manhour but now the national average is up to approximately 5.0—ranging all the way up to 20 kwhr per manhour in some industries.

The new textile mill modernization program includes a sound-color motion picture, "Textiles Unlimited," and a 104-page manual, "How Textile Mills are Modernizing."

MANUFACTURING BRIEFS

Woodward Governor Co has announced that it will hold its thirteenth Prime Mover Control Conference September 13-16 at its plant in Rockford, Ill.

The period from Oct 1 through Oct 9 has been proclaimed by Mayor Martin H. Kennelly, of Chicago, as National Electrical Living Week in Chicago. The second annual National Television and Electrical Living Show is to be held at that time under the sponsorship of 600 leading companies of the electrical industry.

A Canadian subsidiary to manufacture fluorescent lamps and other lighting equipment has been formed by Sylvania Electric Products, Inc. To be known as Sylvania Electric (Canada) Ltd, the new company has leased a plant from the city of Drummondville in the Province of Quebec. The building is being reconditioned by the city to the company's specifications. F. J. Healy becomes president of the new Canadian company; R. H. Bishop, vice-president and William O'Keefe will manage the plant. J. C. Hicks has been named sales manager of the company, with offices in Montreal.

Construction has begun on a new and modern building to house the Westinghouse Educational Center. Located on a 10-acre plot on Ardmore Boulevard, not far from the East Pittsburgh plant, the new building will provide facilities for all advanced educational programs carried on by Westinghouse. A. C. Monteith, vice-president of the company, is president of the Center.

Marathon Electric Manufacturing Corp. Wausau, Wis., has purchased controlling interest in the Burke Elec-

NEED A TIGHT SEAL FOR CABLE ENTRANCES, SERVICE BOXES, CONDUIT ENDS?

...then use

Johns-Manville

DUXSEAL

DUXSEAL is the "Handy Andy" of sealing compounds for closing up conduit and duct ends . . . for sealing openings around wires and service boxes . . . for quickly plugging up drill holes in foundations.

Stays plastic—It stays soft indefinitely, can be used in any weather just as it comes from the package.

Stays tight—It adheres to duct walls and cables, but gives with the expansion or contraction of the wire.

Stays insoluble—It is unaffected by ground waters, gases and low heats, will not slump, melt or run.

Stays re-usable—It can be re-used to form a new *tight* seal after years in service.

Tight seals for other electrical uses

J-M TRANOLSEAL . . . for use with electrical equipment using dielectric oils.

J-M UNISEAL . . . for caulking against weather and humidity. Resists temperatures up to 180 F.

For further information on any of the above sealing compounds, write to Johns-Manville, Box 290, New York 16, N. Y.

JM

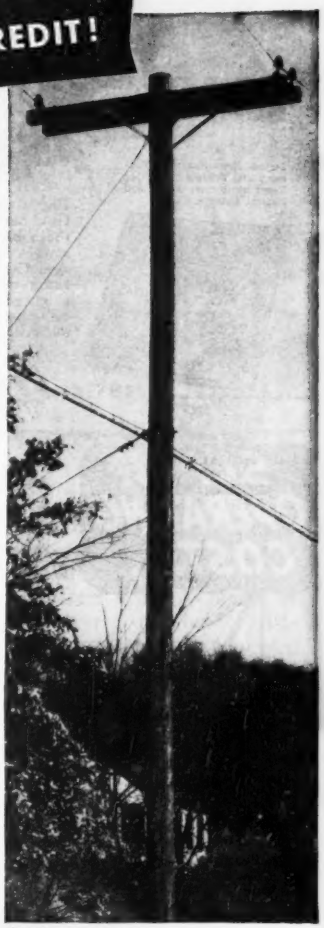
Johns-Manville

SEALING COMPOUNDS

CASE HISTORY

confirms 30-year service life for treated poles

. . . AND CREOSOTE GETS THE CREDIT!



HERE's a convincing case history* concerning 71 pressure-creosoted pine poles—part of an electric power transmission line erected in Kansas in 1917.

In 1947, after 30 years in line, 68 out of 71 poles were still sound and serviceable—furthermore, the inspection revealed that these poles appeared to be capable of service for some time to come. Of the remaining 3 poles, 2 had been removed because of line changes—1 had been damaged by lightning.

Of the original 71 poles, *not a single one had been removed because of decay*—a splendid testimonial to creosote. And all the more noteworthy when you consider that the preservative treatment used to protect these poles was somewhat lighter than is now regarded as good practice.

Creosote is the performance-proved, time-tested preservative for poles and crossarms. And for the best possible creosote delivery service, get in touch with the nation's largest distributor—Koppers. With 14 creosote-producing plants—with 4 large storage plants—Koppers can always meet your creosote requirements.

KOPPERS COMPANY, INC.
Pittsburgh 19, Pa.

* Wood Preserving News—1947

All Standard Specifications
For All Types of Wood Preservation

KOPPERS **CREOSOTE**...*to be sure!*

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

IF you want a tape with a grip you can trust—try Gold Seal. Hot or cold, rain or shine, it sticks to the job—speeds the work. Laboratory control assures lasting "tack" in the friction compound. And Gold Seal will not dry out, peel, ravel or smear the hands. Next time try Gold Seal—in single rolls or handy 10-roll containers—each roll cellophane wrapped. Jenkins Bros. (Rubber Div.), 80 White St., New York 13, N. Y.

JENKINS Gold Seal Tapes
FRICTION...RUBBER

SLASH OPERATING COSTS...

with Tel-E-Lect
POLE LINE EQUIPMENT

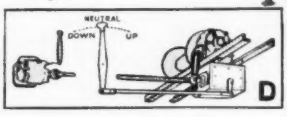
For installation on your present truck—or on new equipment

A **POLE HOLE DIGGER** . . . Uses your regular derrick and crew. Attaches by a single bolt to power take-off shaft. Adjustable for clean holes up to 10 feet deep. Interchangeable augers 8 to 20 inches diameter.

B **DERRICKS** . . . Both "A" frame and "T" type for front or rear mounting on all makes of trucks.

C **UTILITY CABINETS AND MATERIAL RACKS** . . . Bolts onto any flat bed truck. Gives needed facilities for pole line work at a fraction of the cost of a utility body.

D **WINCH DRIVE BOX** . . . Gives instant forward and reverse action to your winch. Permits operator to give all his attention to the winch job and speeds up work. *Easy to operate:* Simply engage power take-off just once. No further shifting to PTO or use of truck clutch required. Just move a single cab lever forward or backward to lower or raise the winch line. Available for single or double drum winches.



For literature or demonstration, write to
TEL-E-LECT PRODUCTS, INC.
10003 MINNETONKA BLVD. • MINNEAPOLIS 16, MINN.

tric Co, Erie, Pa., as part of a program to expand Marathon's sales line. The Burke name will be retained, as well as present production plans, except for a few changes in tooling.

Enlarging its production capacity manyfold to take care of growing demands for steatite products and porcelain insulators, Isolantite Manufacturing Corp, formerly of Warren St, Lyndhurst, N. J., is now located in its recently completed plant in Stirling, N. J.

Expansion of the water treating equipment sales division of the Worthington Pump & Machinery Corp, Harrison, N. J., and the transfer of that division to the corporation's Dunellen Works at Dunellen, N. J., have been announced. Additions have been made to the engineering staff at Dunellen to take care of the expanded activity.

Sale of GE's cold molded plastics business to the Garfield Manufacturing Co, Garfield, N. J., has been announced by the GE chemical department as a final phase in the closing of the department's Meriden, Conn., plastics plant. GE is discontinuing production of cold molded plastics in order to give more emphasis to the growth of the company's thermosetting and thermoplastic molded and laminated lines.

•

Portable Appliances to Be Promoted by Universal

Encouraged by substantial factory unit sales increases in small appliances during the past two months, Landers, Frary & Clark will spend 65% of its entire 1949 advertising and promotional budget for these items, Robert M. Oliver, general merchandise manager, portable electric appliance division, revealed at a recent press conference in New York.

Volume in the last four months of the year is expected to exceed the like 1948 period by 50%, Mr Oliver predicted.

Details of the promotional campaign will be made available at distributor meetings in 43 cities throughout the country beginning Sept 6. Meetings will include a complete product presentation of the Universal portable electric appliance line and details of Value Demonstration Parade program, advertising, promotional and displays for retailers, special merchandise offerings, etc.

Retailers will be invited to learn of the fall promotional drive in a series of hotel showings immediately following the distributor meetings.

R. N. Campbell, vice-president in charge of manufacturing for the divi-

10 WIREMOLD SURFACE RACEWAY SYSTEMS

. . . meet the wiring needs of every job.

No. 200
For branch circuits . . . extension from existing outlets . . . or to provide switches or additional outlets.

No. 500
For branch circuits . . . extension from existing outlets . . . or to provide switches or additional outlets.

No. 700
For branch circuits . . . extension from existing outlets . . . or to provide switches or additional outlets.

No. 1000
A branch circuit feeder direct from panel box.

No. 1100
For wiring infra-red ovens . . . show window lighting.

No. 1500
An over-floor system for light and power and telephone circuits to locations away from walls.

No. 1900
A plug-in-anywhere wiring system for outlet convenience in factories, hotels, offices, apartments, homes, stores, etc.

No. 2100
A plug-in-anywhere wiring system . . . or a distribution system for lighting fixtures.

No. 2600
For interoffice telephone wiring requiring additional circuit capacity.

No. 3000
A branch circuit feeder system direct from panel box to machine tools, lighting fixtures, portable power tools, etc.

WRITE FOR "WIRING GUIDE"

Know your WIREMOLD

MORE THAN ADEQUATE WIRING

THE WIREMOLD COMPANY
HARTFORD 10, CONN.

sion, said some production lines will operate on a two or three-shift basis to meet demand expected to be created by promotional efforts. Additional workers are now being hired and much additional equipment has been installed, he said.

•

Westinghouse Receives Record French Order

Westinghouse Electric International Co has received an order from French steel interests for $9.5 million worth of electrical steel mill equipment, William E. Knox, president, has announced. The order, claimed to be the largest single order of its type ever placed, consists of electrical equipment for two new steel mills at Hayange and Ebange, towns in the iron-ore producing Moselle sector of northeast France, he said.

Sollac (Societe Lorraine de Laminage Continu), a privately owned association of nine French steel firms, placed the order. When completed, these mills will process a minimum of 850,000 tons of raw steel annually into light plate sheet steel and tin plate, Mr Knox stated.

For the first phase of the modernization program, Westinghouse will supply electrical equipment including motors, generators, switchgear, and controls for an 80-in continuous hot-strip mill at Hayange and for a 48-in five-stand continuous cold-strip mill at Ebange.

•

Manufacturers Make New Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

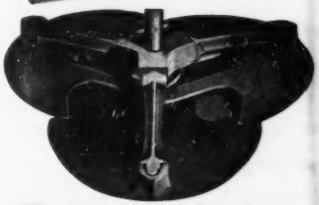
Marcus Transformer Co, Inc, Hillside, N. J., has appointed the L. Morris Landers Co, 315 Walton Bldg, Atlanta 3, Ga., representative for Alabama, Florida, Georgia, North Carolina, South Carolina, Mississippi, and Tennessee.

General Switch Corp, Brooklyn, N. Y., has appointed Gene Hagen & Co, St. Louis 6, Mo., sales agents to cover Missouri east of Springfield, western Kentucky, southern Illinois, and Memphis, Tenn. Fred E. Searls, Kansas City 4, Mo., has been made sales representative in western Missouri, Iowa, Kansas, and Nebraska.

McGraw Electric Co, Toastmaster Products Division, has appointed Rowland H. Caugherty sales representative for the southeastern territory. He will make his headquarters in Atlanta, Ga., and cover the states of Georgia, Florida, and parts of Alabama and Tennessee. Stephen W. Rich has been appointed sales representative in the Cincinnati territory. Mr Rich will cover parts of Ohio, Illinois, Kentucky, Indiana, and West Virginia and will make his headquarters in Cincinnati.

EVERSTICK ANCHORS...

First Choice for PERMANENCE HOLDING POWER LONG LIFE SAFETY



They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install — made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way and cone types. Write for facts.

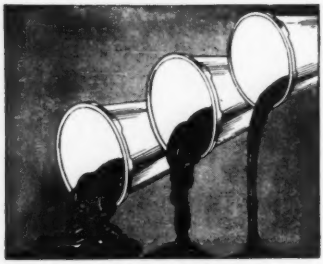
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "The Anchor of Merit"
FAIRFIELD, IOWA

Insulating and Cable-Pulling

COMPOUNDS

of Record-Breaking Performance



Minerallac gives you a complete assortment for every need: dense, viscous and fluid consistencies for high and low voltages in cable-joints, pot-heads, terminal bills, distribution cables, street lighting, telephone work. . . . Insoluble in oil or water, for all temperatures. Clean, safe, economical—outranks all others in quality.

Send for new literature and prices.

MINERALLAC ELECTRIC COMPANY
25 North Peoria Street—Chicago 7, Illinois

MINERALLAC

ELECTRICAL SPECIALTIES

FOR HEAVY INDUSTRIAL SERVICE

RMC

FROM STOCK

Soldering Lug | 3-Conductor Angle Pothead | Single Conductor Pothead

Write for a complete selection of RUSGREEN bulletins

ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

RUSGREEN MFG. CO.
14260 Birwood Avenue • Detroit, Mich.

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Colo., Colorado Springs—At Office, city mgr., City, Colorado Springs, one 14,000 gpm induced draft cooling tower at municipal electric plant. Lurz & May, 819 Finance Bldg., Kansas City, 6, Mo., consult. engrs.

Colo., Montrose — Western Colorado Power Co., Montrose, steam electric plant, **$1,250,000.**

Ga., Augusta — City, city clk., night lighting system at Bush Feld. Plans deposit $25.

Louisiana—U. S. Eng., foot Prytania St., New Orleans, electrification Plaquemine Lock, Serial No. Eng. 50-53, Iberville Parish.

La., Monroe—City, City Hall, furnishing and installing steam generating units, turbine generators, surface condensors, for power plant, Ford, Bacon & Davis Constr. Corp., 39 Broadway, New York, Zone 6, N. Y., engrs.

Neb., Hastings—Bd. Pub. Wks., Hastings, water and light plant, equip. etc. $285,500. Black—Veatch, 4706 Broadway, Kansas City, Mo., engrs.

North Dakota—Case County Electric Co-operative, Kindred, labor for 314.33 mi. rural distr. lines, Barnes and Cass Counties. $350,000. Ulteig Eng. Co., 1114½ Front St., Fargo, engr.

Oregon—U. S. Eng., Pittock Block, Portland, Zone 5, furnish six 29,000 kva transformers for Detroit dam powerhouse on North Santiam River, delivery f.o.b. at Gates Marion Co. $750,000.

Tex., Fort Worth—Beard & Stone Electric Co., 13 and Macon Sts., 1 story 150x200 ft. rein.-con. stone and grainite trim generator service bldg., air-conditioning, paved parking space. $100,000-$250,000. Plans deposit $25. Wilson & Patterson, 209 Majestic Bldg., archts.

Low Bidders & Contracts Awarded

California—Bureau Reclamation, Dpt. Interior, Box 2511, Sacramento, Aug. 23, transmission lines, Elverta-Perkins, Central Valley Proj., Sacramento Co., etc., from American Bridge Co., Frick Bldg., Pittsburgh, Pa., **$221,405.**

Ia., Des Moines—Iowa Power & Light Co., 312 6 St., general contract, plant bldg., from Weitz Co., Inc., 406 Fleming Bldg., **$551,800.** Brooks-Borg, 820 Hubbell Bldg., archts.

Ill., Lincoln—State of Illinois, Dpt. Welfare, Springfield, Lincoln State School and Colony, Power Plant and utilities, incl. power piping, heating and ventilating to Gallaher & Speck, 546 W. Harrison St., Chicago, **$292,000***boiler and stoker to Springfield Boiler Co., 1901 E. Capitol Ave., Springfield, **$318,531***two 700 KW turbo generators to Elliott Co., Jeanette, Pa., **$94,390***plumbing to S. E. McDaniel Plumbing & Heating Co., Decatur, **$119,700***pipe covering to Asbestos & Magnesia Materials Co., 123 N. Peoria St., Chicago, **$77,891***electric underground distr. sys., to Wadeford Electric Co., 205 W. Wacher Dr., Chicago, **$75,432.** Grand total $977,944. Bids 7/19. Awarded 8/17.

Md., Baltimore—Consolidated Gas Electric Light & Power Co., Lexington Bldg., 1 and 2 story masonry, concrete steel plant alterations and addns., 700 Constitution St., Cummins-Hart Constr. Co., 2023 N. Charles St., $250,000. Taylor & Fisher, 1012 N. Calvert St., archts.

Missouri—M & A Electric Power Cooperative, Poplar Bluff, 144 mi. 69 KV rural distr. lines, from Poplar Bluff to conect to substations at Puxico, Idalia, Malden, Anniston, Matthews, Delta, Van Duser and Lucesville, and 9 substations, to Delta Constr. Co., Clarksville, Miss., **$671,-254.** Bids 7/19.

IT'S TOO TOUGH FOR ME!

There's a lot of satisfaction, and peace of mind, too, in knowing your property is protected by a Stewart Chain Link Wire Fence. Stewart's famous All Beam fence framework construction is the heaviest and strongest manufactured . . . built to give the utmost in protection and many extra years of low cost service. Write for Catalog No. 83. It contains complete details.

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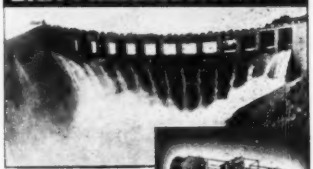

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Missouri — Webster Electric Co-operative, Hugh Bennett, mgr., Marshfield, 88.58 mi. rural distr. lines, Christian, Dallas, Greene, Webster and Wright Counties, to Reinhart & Donovan Co., Commercial Exchange Bldg., Oklahoma City, Okla. **$115,357.** Bids 8/4.

Montana—Sheridan County Electric Cooperative Medicine Lake, Aug. 9, 284 mi. rural distr. lines, Sheridan and Roosevelt Counties, from Sydney T. Olsen Jr., 238 Ave. D., Billings, **$315,068.**

Nebraska — North Central Nebraska Rural Pub. Power Dist., Creighton, Aug. 18, 315.3 mi. rural distr. lines, Antelope, Knox and Holt Counties from W. L. Coston & Sons, 1st Natl. Bank Bldg., Birmingham, Ala., **$295,549.**

Oregon—Bonneville Power Admin., 729 N. E. Oregon St., Portland, Zone 8, Aug. 26, clearing 14.25 mi. right of way, Lakeside-Coos River sect. of Reedsport Coos Bay 115 kv. transmission line, Inv. 4765, Coos Co., from N. P. Logging Co., Coquille, **$157,667**; clearing 44.6 mi. right of way for Warm Springs sect. of Maupin-Detroit 230 kv transmission line, Wasco Co. Inv. 4761 from V. & M. Operating Co., Oswego, **$129,000.**

South Dakota—U. S. Eng., 1709 Jackson St., Omaha, Neb., Aug. 25, generators for Fort Randall Dam Proj. Serial No. Eng-25-066-49-254 from Westinghouse Electric Corp., 117 N. 13 St., Omaha, Neb., **$4,304,351.**

S. D., Mobridge—Montana-Dakota Utilities Co., Mobridge, power plant to Stearns-Rogers Mfg. Co., 1720 California St., Denver, Colo., **$2,000,000.**

Utah—Bureau Reclamation, Dpt. Interior, Provo, Aug. 23, construct Murdock diversion dam and Provo reservoir canal, Station 2 plus 86.37 to 5 plus 55, Spec. 2741, Provo River Proj., Deer Creek Div. from Thatcher & Mayberry Constr. Co., Ogden, **$147,265.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Mo., Kansas City—U. S. Eng., 601 Davidson Bldg., Kansas City, Aug. 24, veterans administration hospital, Serial No. Eng., 3-028-501, from Del Webb Constr. Co., S. 23 Ave., Phoenix, Ariz., **$7,936,000.**

N. Y., Ithaca—At office Bertram D. Tallamy, supt. Pub. Wks., State Office Bldg., Albany, general constr., heating, sanitary, electric and elevator work for Agricultural library and classroom bldg., etc., New York State College of Agriculture, Cornell University.

N. Y., Syracuse—Veterans Admin., Vermont Ave., between H and I Sts., N. W. Wash. 25, D. C., (I) general constr., incl. roads, walks, grading, drainage, wrecking and removing certain structures; mechanical work, outside distr. sys., and (II) electric elevators and dumbwaiters; (III) refrigeration equip. for Veterans Hospital, approx. 4,957,000 cu. ft. Hospital Bldg. No. 1; approx. 88,000 cu. ft., Apartment Bldg. No. 2; approx. 35,000 cu. ft. Attendants Quarters Bldg. No. 3; approx. 75 ft. Steel Flag Pole No. 6; one underground soft water reservoir No. 7, approx. 2,000 cu. ft.; approx. 700 cu. ft. underground brine storage Basin No. 8, structural steel frame, brick faced with stone trim and backed with hollow tile, concrete fdns. Spec. 4920B.

Low Bidders & Contracts Awarded

Mich., Ann Arbor—Veterans Admin., 1807 Munitions Bldg., Vermont Ave. between H and I Sts. N. W. Wash. 25, D. C., hospital Spec. 4920 to Hedin Constr. Co., 820 Michigan Ave., N. E., Wash., D. C., **$7,152,000.** Bids 8/9. Awarded 8/24.

N. Y., Buffalo—Ford Motor Co., 3000 Schaefer St., Dearborn, Mich., concrete substructure for 1 story concrete, steel 1,000,000 sq. ft. stamping plant and supply bldg. in Hamburg Twp. near here to Darin & Armstrong, 2041 Fenkell St., Detroit, Mich. Total est. **$10,000,000.**

N. Y., New York—New York University, Washington Square, law center bldg. on Washington Square South, to John Lowry, Inc., 52 Vanderbilt Ave., **$3,000,000.**

Tex., Victoria—E. I. duPont de Del., 9 plant bldgs., and 4 service bldgs., for Nemours & Co., du Pont Bldg., Wilmington, mfg. of nylon chemicals on 1700 acre site on Guadalupe River, purchase and hire. Approx. **$16,500,000** and **$2,750,000** respectively.

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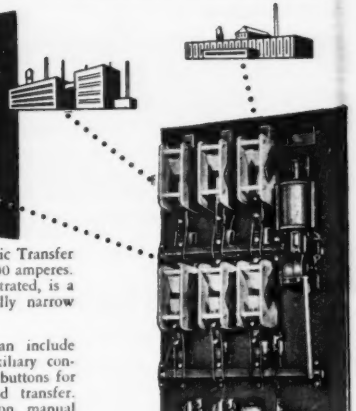

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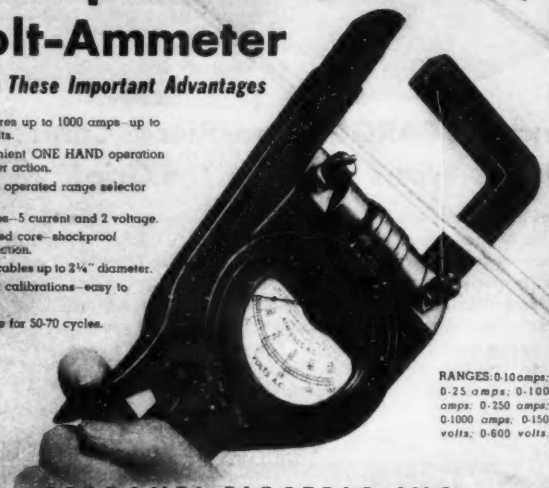

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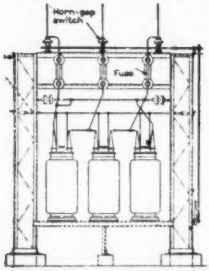

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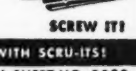

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RECENT RATE CHANGES

Utah Power & Light Co has been denied increased rates sought for expansion purposes in hearings before the Utah Public Service Commission. The utility on March 7 asked rate increases that would have provided $1,324,405 in additional annual revenues, stating the rate boost was needed to attract sufficient capital for completion of its $61,000,000 five-year construction program. During the hearings witnesses for UP&L testified that capital for the construction projects would cost at least 6.25% and that the firm would be hard-put to obtain the needed funds without a rate increase. However, such organizations as the Utah Consumers Welfare League and the Utah CIO claimed that the utility had effected a reduction in its debt cost, and petitioned instead for a rate reduction that would bring company income down to a 5.5% figure. Announcing its decision in the matter, the state commission denied both company and consumer petitions, maintaining the current rate structure. President and General Manager George M. Gadsby of UP&L stated: "We are disappointed in the Public Service Commission action. In spite of the steady and large increases in the costs of labor, taxes and materials since 1943, the company has neither sought nor received any increase in its electric rates . . ." Immediately following the adverse Utah rate decision, officials of UP&L withdrew an application for a rate increase in Idaho. Company spokesmen pointed out a desire to keep Utah and Idaho rates equalized if possible. In its ruling on the Utah rate increase application, Utah Public Service Commission confined itself to stating that testimony indicated a return to the company of 6% during 1948, a return the commission held to be "fair and reasonable."

Pennsylvania Power & Light Co has filed new tariffs with the state Public Utility Commission, calling for increased electric rates for nearly all of its customers, effective Oct 24 1949. The new rates, if approved by the commission, will boost the company's annual revenue by $2,126,100, or 3.9%. The new rate schedule replaces two other proposals withdrawn by the company in July. The first proposal, filed April 21, and suspended by the commission for six months, called for rate increases amounting to $2,240,000 annually. The second proposal would have boosted rates by $2,096,300 yearly. The latest filing, designed to meet objections of the Pennsylvania Grange, reduces the amount of increase to be borne by farmers and residential users, compared with the previously withdrawn schedule. Rates of large industrial users will remain unchanged. Commercial users will pay more than previously contemplated.

Otter Tail Power Co, Fergus Falls, Minn., in an initial decision by FPC, has received approval of its rate filings, which increase rates and charges on the company's wholesale sales of electric energy by approximately $365,000 annually. The decision is subject to the filing of exceptions by the parties within 20 days and review by the Commission. The new schedules, which affect rural electrification cooperatives and municipalities in Minnesota and North and South Dakota, have been in effect since Aug 1, pending final decision by the commission.

TECHNICAL LITERATURE

Aluminum—"Finishes for Aluminum" is a reference book of a revised and combined two-volume book published in 1946. Some chapter subjects are characteristics and properties of aluminum, cleaning treatments, mechanical finishes, eletcrolytic oxide finishes, electroplated finishes, organic finishes, controls and tests. When a request is made on a company letterhead, a copy of the book will be sent by Reynolds Metals Co, 2500 South Third St, Louisville 1, Ky.

Boiler Auxiliaries — A report entitled "Boiler Auxiliaries, 1948," contains committee and operating company statements on coal flow from bunkers, pulverizer exhauster maintenance, superheat control, water level indicators and recorders, and chimney design and maintenance. This report, publication R-8, price 30¢ to members, is obtainable from Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

Steam Turbines—"Test Code for Steam Turbines" and Appendix to Test Code for Steam Turbines have been developed by the ASME Power Test Codes Committee. Each publication is available at $2 per copy from American Society of Mechanical Engineers, 29 West 39th St, New York 18, N. Y. Price is $3.50 when Test Code and Appendix are on the same order.

Cost Data—Cost data of 200 of the nation's most modern steam-electric generating plants, collected over the 10-year period from 1938 through 1947, have been made available by the Federal Power Commission, Washington 25, D. C., for $3.00 each. The new publication is entitled "Steam-Electric Plant Construction Cost and Annual Production Expenses," the order number is FPC-5-72. Capacity of the 200 plants represents approximately 65% of the nations' total. Net generation of these plants for 1947 was about 73% of the total electric energy generated in steam-electric plants by electric utilities in the United States. The index includes references to engineering articles regarding many of the plants.

Resistance—"Master Test Code for Resistance Measurement" covers standards, general techniques, methods, applications such as temperature measurement, measurement of insulation resistance and ground resistance. Designated publication 550, it is issued by American Institute of Electrical Engineers, 33 West 39th St, New York 18, N. Y.

Steel Sheets—Engineering Manual No. 3 presents properties of USS electrical steel sheets for rotating machines, transformers and other forms of electrical devices requiring laminated core materials. Sections include characteristics curves of the principal grades, incremental permeability characteristic curves at low a-c flux densities, general engineering data applying to electrical sheets and other steel products; and non-technical description of the production, testing and uses of electrical sheets and the terminology involved. The manual is published by Carnegie-Illinois Steel Corp, 434 Fifth Ave, Pittsburgh 30, Pa.

Standards—These publications have been issued by American Institute of Electrical Engineers, 33 W. 39th St, New York, 18, N. Y.; 550—*Master Test Code for Resistance Measurement;* 600—*Recommended Specification for Speed-Governing of Steam Turbines Intended to Drive Electric Generators Rated 500 kw and Up;* 601 and 602—*Preferred Standards and Standard Specification Data for Generators for*

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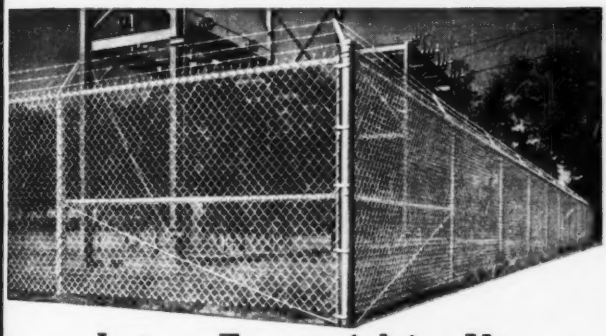

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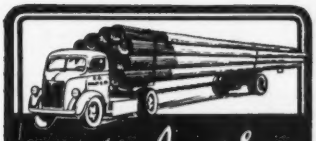

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Power Switching Equipment — Rating, manufacturing and application standards for bus supports and air switches; rating, performance and application standards for air interrupter switches; and application standards for outdoor substations, are contained in Publication 45-94, *Standards for Power Switching Equipment*, issued by National Electrical Manufacturers Association, 155 E. 44th St, New York 17, N. Y.; price $2.75.

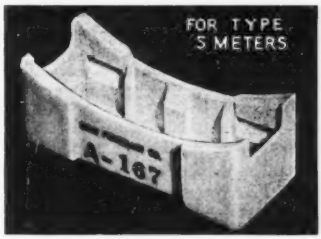
Transformers—*Instructions for the Care and Maintenance of Oil-Immersed Transformers* has been prepared as being applicable for transformers rated above 100 kva, below 15,000 v, and all sizes above 15,000 v; and to distribution transformers rated 100 kva and smaller, 15,000 v and below. It is Publication 49-143 obtainable, price 60¢, from National Electric Manufacturers Association, 155 E. 44th St, New York 17, N. Y.

Timber Beams—Research Bulletin 23 entitled *Timber Beams Reinforced with Spiral-Drive Dowels* is a study of the effect (1) of reinforcing timber beams with screw dowels, and (2) of splicing two shallow beams to make one deep one. The bulletin has been issued by the Engineering Experiment Station, West Virginia University, Morgantown, W. Va.

Welding—*Practical Aspects of Inert-Gas Welding* is a 16-page publication offering a resume of inert-gas, shielded-arc welding, including a description of the process, gases used, electrodes, straight vs reversed polarity, d-c and a-c welding equipment, techniques in welding aluminum, copper magnesium, steel and other metals. Copies may be obtained from Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.

Chemical Consultants—*Consulting Services*, 12th edition, contains about 100 headings, members specializing or qualifying in the field, a description of each member's qualifications, and an index of members, alphabetically and geographically. Requests for this 132-page publication, formerly *Classified Directory*, 11th ed, must be addressed to Association of Consulting Chemists and Chemical Engineers, Inc, 50 E 41st St, New York 17, N. Y., giving source of reference, name of person and company and complete address.

Tables—*Tables of Sines and Cosines to Fifteen Decimal Places at Hundredths of a Degree* is Publication AMS-5 issued by National Bureau of Standards. Copy of the 95-page book is obtainable, at 40¢, from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.



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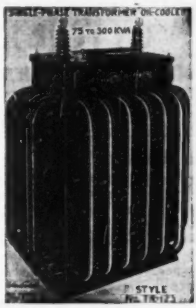

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LETTERS TO THE EDITOR

Relaying Conference

To the Editor of ELECTRICAL WORLD:

In the June 25, 1949, issue of ELECTRICAL WORLD, you referred to the Conference on Protective Relaying recently held (June 16th and 17th) at the Georgia Institute of Technology as being the first conference of its kind.

Our first Conference for Protective Relay Engineers was held at the A&M College of Texas, College Station, Texas, March 8–13, 1948.

The Second Annual Conference for Protective Relay Engineers was held at the A&M College of Texas March 14–16, 1949. An announcement of this second conference was carried in your magazine for several months prior to the conference. A report on this second conference was given at the Southwest District Meeting, AIEE, at Dallas, Texas, in April, and a digest of this report appeared in the June, 1949, issue of *Electrical Engineering*.

This conference, which is sponsored by A&M College of Texas, is an annual affair. The Third Annual Conference for Protective Relay Engineers has been scheduled for March 20–22, 1950.

L. M. Haupt, Chairman
Conference for Protective Relay Engineers
Agricultural & Mechanical College of Texas
College Station, Texas

Don't Shoot the Right-of-Way Man

To the Editor of ELECTRICAL WORLD:

Under The Electrical Week in your publication of July 30, 1949, you have a paragraph in praise of The Right-of-Way Man. I appreciate this and I think every right-of-way man that reads it will be glad to know that one national publication has given him recognition.

The only other similar mention that I can recall is in the picture of the life of Jesse James—in one scene Jesse James shoots the right-of-way man (Brian Donlevy).

I believe you should have had a little build-up of small arms fire instead of putting the full charge into one big boom. That's an idea tho—you might work up some good copy if you gave the right-of-way-man of the utility industry, particularly, a good big writeup.

D. M. Rusk, Manager
Right of Way & Real Estate Department
Ohio Power Co
Newark, Ohio

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CHICAGO: 520 N. Michigan Ave., (11)
SAN FRANCISCO: 68 Post St., (4)

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WANTED RELAY Engineer, first class, graduate, for large power system, Southwest. Must have minimum of five years experience in planning, coordinating, testing and repair of modern power system relaying. Furnish photo with experience record. P-9773, Electrical World.

ELECTRICAL—MECHANICAL Engineer with experience in design and development of small relays and light duty oil switches. Excellent opportunity for the right man with established midwest manufacturer. State briefly qualifications, experience, age and salary expected in first letter. Address P-9835, Electrical World.

WANTED
RELAY ENGINEER

Minimum of one and one-half years' experience in field work, checking, setting and testing protective relays and associated equipment and control circuits, to work for a large eastern public utility company on protective relay application, relay specifications, short circuit calculations, relay settings, schematic diagrams, and associated work. Location: Western Pennsylvania. Qualifications, experience record, and picture should be submitted with letter of application.

P-9847, Electrical World
330 W. 42nd St., New York 18, N. Y.

SALESMEN — 2

Manufacturer of construction materials for transmission and distribution systems has openings for two experienced salesmen, graduate electrical engineers twenty-eight to forty years of age. Area to be traveled is in the Middle West. Give short transcript of experience and education. Our representatives know of this advertisement. Reply

SW-9908, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

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Long established eastern manufacturer selling to power companies and industrials seeking direct sales representative for Texas and Oklahoma. Electrical engineering background desirable.

SW-9856, Electrical World
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Looking for SALES Representation in Philadelphia Area for sale of Power and Distribution Transformers.

RW-9654, Electrical World
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POSITIONS VACANT

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UTILITIES DESIGN Engineer. Desire Mechanical Engineer or an Electrical Engineer "turned" Mechanical, with ten to fifteen years of experience in Power Field. Will be responsible for all Engineering Design Work associated with the supply distribution of steam, electricity, water, gas, and air on projects designed for Company's six plants. Unusual advancement opportunity, good salary, limited traveling, outstanding retirement, vacation, and insurance plans. Location in Southern Michigan. Please submit complete data with application. P-9870, Electrical World.

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1— 75 HP. Whse. CS. 1200 rpm, 2300 volts, 3 phase, 60 cycle.
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1— 100 HP G.E. Type IM 400 RPM 440 volt.
1— 100 HP G.E. 720 rpm 440v, 25 cy. IM.
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1—65 HP. 500/1500 rpm General Electric.

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1—1000 KW Westinghouse 275 volt, 720 RPM 4000 volt Syn.
1—1000 KW General Electric 600 volt 514 RPM 4000 Volt Syn.
1—500 KW. G.E. 250v 900 rpm 2300v Syn.
1—500 KW. G.E. 575v 900 rpm 2300v Syn.
1—125 KW. Crocker Wheeler 1200 rpm 125v Generator 2200v S.C. Motor.
1—100 KW. Elect. Mach. 1800 rpm 125v Generator 4150 Syn. Motor.

PLATING GENERATORS
1—1½ KW. G.E. 5/6v with sq. cage mt.
1—12 KW. Hansen Van Winkle 24v 1200 rpm. 20 HP. General Electric KF Motor.
1—3000 Amp. Chanderson. 6/12v 400 rpm Syn. Motor.
1—2500 Amp. ditto.
1—625 KVA West. Reduction Gear Turbo Generator Non-Condensing. 2400v 3 ph 60 cy.

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1—1000 KVA G.E. 3 ph. 4150 volt to 2400 volt.
3— 400 KVA G. E. 6900 V. Pri.—2300 V. Sec.
3— 300 KVA Pitts. 2300v pri. 115/230v sec.
3— 300 KVA G.E. type H. 2300v pri. 115/230v sec.
3— 150 KVA West. 2300 volt Pri. 240/480 sec.
1— 150 KVA G.E. 2300v 110-220v.
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4—200/100 HP. Whse. 720/360 rpm 4150v.
1—200 HP. General Electric 257 RPM 440 volt.
1—100 HP. G.E. type TS 600 rpm 4400v D.C.
2—150 HP. Allis Chalmers, 360 RPM. 2200 volt.

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4000 KW TURBINE GENERATING PLANT
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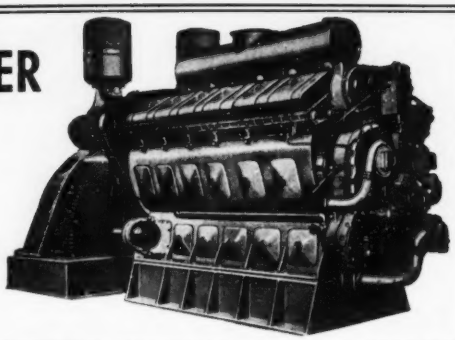

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KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1420	Fairbanks Morse	38D8⅛	1600	720	375	Enterprise	DSG-6	450	450
1250	General Motors	16-278A	1600	720	312	General Motors	8-268A	450	1200
1000	General Motors	12-278A	1200	720	187	Ingersoll Rand	S	225	514
937 5	General Motors	12-567	1100	720	125	General Motors	3-268A	150	1200
625	Alco	6-12½x13	750	600	75	General Motors	6043C	90	1200
425	Baldwin	VO-6	510	450	62	Int'l Harvester	UD-18	76	1200

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2—150 KVA Eisler Pri. 2300/4600 Sec. 230/460 3 Ph. 60 Cy.
3—150 KVA G.E. Pri. 2300/4000Y Sec. 115/230 1 Ph. 60 Cy.
3—100 KVA G.E. Pri. 6900/11950Y Sec. 230/460 1 Ph. 60 Cy.
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D. C. MOTORS

Qu.	HP	Make	Type	Volts	Speed
1—	2000	Whse.		600	600/720
1—	1750	Whse.		600	550/700
1—	1400	Whse.		525	600
1—	1200	Whse.		600	525/700
1—	700	G.E.	MCF	600	150/525
1—	350	G.E.	MPC	250	115/145
1—	800	Whse.		600	800/950
3—	600	G.E.	MPC	600	600/720
1—	325	Whse.	MQ	250	300/900
1—	300/300	G.E.	MPC	220	360/950
1—	275	Whse.	QM-600.6	230	425, 850
1—	250	G.E.	MPC	230	400/800
1—	230	Al. Ch.		230	700
3—	180	Whse.	SK-200	230	600
1—	180	Cr. Wh.	CMC-65H	230	1150
1—	150	G.E.	MPC	230	230/460
1—	140	Cr. Wh.	152HL	230	300/1050
3—	130	Cr. Wh	TEFC-87H	230	890
1—	150	G.E.	CD-B-Brg.	600	250/750
3—	138	G.E.	CO	230	625
1—	138	El. Dy.	308	230	750/1560
1—	115	Cr. Wh.	JHL	230	1200
1—	100	G.E.	CD-175	230	385/730
1—	100	G.E.	MPC	230	225/450
3—	100	Whse.	SK-Vert.	230	485/950
1—	100	Rel	1050T	230	400/1200
1—	80	El. Dy.	308	230	475/950
3—	75	Cr. Wh.	85H-TEFC	230	880
1—	75	Whse.	SK-150	230	650
2—	75	G.E.	CDM-1126Y	230	2000
2—	75	El. Dy.	258L	230	750/1750
1—	75	Cr. Wh.	CMC-65H	230	500/1560
3—	60/75	Whse.	SK-200	118	300/700

SYNCHRONOUS CONDENSERS

Qu	KVA	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4150	900
1	3000	Whse.		2400	720

MOTOR GENERATOR SETS

3 Ph. 60 Cycle

Qu.	KW	Make	Speed	DC Volts	AC Volts
1	2000(300)	Whse.	720	600	2300
1	1500	G.E.	360	275	2300/4400
1	1500	G.E.	600	600	4150
1	1500	Whse.	600	600	4150
1	1250	G.E.	600	275	2300/4150
1	1000	Cr. Wh.	720	250	2300/4150
1	1000	G.E.	720	250	13200
1	1000	Whse.	514	250	4000
1	1000	Whse.	720	600	2300/4150
1	1000	Whse.	900	600	2300/4150
1	800	SUGE	1200	240	2300
1	600	G.E.	720	125	2300/4150
1	500	G.E.	720	600	4400
1	750	Whse.	720	275	2300/4150
1	400	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	350	G.E.	900	125	4150
1	300	G.E.	1200	120/240	440
1	250	Whse.	1200	240	440
1	150	Cr. Wh.	1200	250	220/440
1	140	Cr. Wh.	720	125/250	2200

ROTARY CONVERTERS (60 cycle)

Qu.	KW	Make	Speed	DC Volts	AC Volts
1—	2000	G.E.	514	600	13200
1—	2000	G.E.	450	600	13200
1—	1000	Whse.	900	600	11000
1—	750	Whse.	900	600	13200
1—	500	Whse.	900	250	6600

All units can be furnished with AC and DC Control

MERCURY ARC RECTIFIERS

1	1000	Al. Chal.	B-613	625		13500
*1	1000	S-B	25/60 cy	625	6600/13200	
1	750	G.E.	RHW	575	2300/4000	

*Complete with full automatic A.C. and D.C. controls.

A. C. MOTORS—3 Ph. 60 Cycle

Synchronous

Qu.	HP	Make	Type	Volts	Speed
2—	3500	G.E.	TS	2300	257
1—	2100	G.E.	ATI	4000	514
3—	2000	Whse.		2300	120
3—	2000	Whse.		2300/4800	900
1—	1470	Whse.		2300/4800	180
1—	1000	Whse.	MILL	2300	180
2—	900	A. Ch.	Eng (new)	2200	164
1—	600	Whse.		440	300
1—	500	G.E.	ATI	440	900
1—	500	G.E.	TS-9532	4160	900
1—	450	Whse.		2200	128.5
2—	350	G.E.	TS	2200	150
1—	320	G.E.	ATI	2300	600
1—	308	Al. Ch.		440	600
1—	300	G.E.	ATI	440	720
1—	300	Whse.	Ene.	2300	720
1—	225	G.E.	ATI	440	900
2—	125	G.E.	ATI	440	450

Slip Ring

1—	1000	Whse.	CW	2300	706
2—	700	Whse.	CW	2200	600
1—	600	G.E.	MT	440	720
1—	500	G.E.	IP	440	503
3—	450	G.E.	IM	440	505
1—	500	G.E.	MIB-IM	2200	450
3—	350	Whse.	CW	2200	900
1—	350	G.E.	MT-442y	4000/23	587
1—	300	A. Ch.	ANY	2300	305
3—	300	Al. Ch.	ANY	2300	705
1—	250	G.E.	MT	4000	327
1—	250	G.E.	MT-5528	2200	720
4—	125	G.E.	MT-568Y	2300	435

Squirrel Cage

1—	250	G.E.	KT-557	440	1780
1—	200	G.E.	KT-557	440	1800
1—	200	G.E.	IK	440	864
1—	125	(new) G.E.	KF TEFC	440	1190
1—	125	G.E.	KF-5328L	440	3600
3—	100	G.E.	KT-643	220/440	1780

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3—	50 KVA	Pitts 26400—2300/4000Y
3—	50 KVA	G-E 33000—2400/4160Y
3—	75 KVA	W-H 230/460—115/230 DRY
3—	100 KVA	G-E 11000—2300/4000Y
3—	100 KVA	G-E 33000—2300/4000Y
3—	150 KVA	L-M 2400/4160Y—120/240
3—	150 KVA	G-E 6600—440
3—	150 KVA	G-E 22000—2300/4000Y
2—	200 KVA	G-E 6900/11950Y—460/230/115
1—	200 KVA	G-E 6600/11430Y—2300
3—	200 KVA	Mol 7200/12470Y—240/480 25 cyc.
3—	333 KVA	G-E 33000—2300/4000Y
1—	400 KVA	G-E 132000—120/240

Many other items in stock

TRANSFORMERS

WANTED

Reliable rewind and repair service on all makes of transformers.

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio

ELECTRICAL CABLE

- for every industrial and power application.
- Specialconstructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular supplier.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2670 N. Clybourn Ave., Chicago 14, Ill.

DIESEL GENERATOR PLANTS

COMPLETE WITH SWITCHBOARDS

1000 KW TO 100 KW

STATIONARY AND PORTABLE

AT GREATLY REDUCED PRICES

NEW UNIT GUARANTEE

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.

Telephone NEvada 6-2808
Cable Address HEMCOY

1412 So. Alameda Street
Compton 1, Calif.

FOR SALE

3-Clark Automatic Air Dump Cars

manufactured in 1923. Capacity 100,000#, 810 cu. ft. weight 58,600#, Length 32'2", width 9'1½", Westinghouse draft gear, coupler shank 6 x 8 C.S., yoke 6 x 1½ key, A.R.A., brake beams #2, K-2-triple, rolled steel wheels. Useable condition.

Contact N. C. STIREWALT, *Vice President*

CENTRAL ILLINOIS PUBLIC SERVICE CO.
ILLINOIS BUILDING, SPRINGFIELD, ILLINOIS

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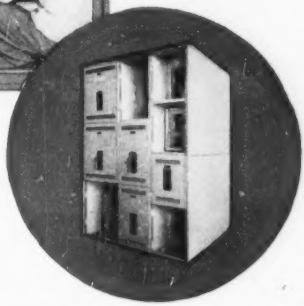
NOW... I-T-E's new Low Voltage MULTUMITE "600" Switchgear gives you

NEW SAFETY NEW CONVENIENCE

with I-T-E METAL-BACK Circuit Breakers!



● Rear view of new I-T-E Multumite unit, with inset showing front view of partly assembled unit.

From I-T-E—*"The Center of Switchgear Progress"*—comes the newest combination in low voltage protection: efficient, dependable *metal-back* I-T-E Circuit Breakers in proved superior I-T-E Multumite enclosures!

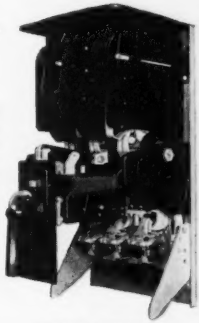
Here's real convenience!

Full-height, hinged rear doors permit inspection of bus and cables with a minimum of work and effort. One horizontal main bus means more space available for power and control cables whether they enter from top, bottom or both. All control wiring is carried within steel channels built into the enclosure frame. And there's plenty of room for mounting terminal blocks and auxiliary equipment in one central location!

Get the complete story on this new development in low-voltage switchgear. Ask your local I-T-E Representative, or write for literature — without obligation, of course.

NEW DESIGN MEANS GREATER SAFETY!

Note the metal panel which forms a steel *barrier* between the breaker compartment and the bus compartment, provides a more effective seal against ionized gases. A self-contained screw-type mechanism prevents the breaker from accidentally moving into or out of the connected position, and positive "bridge-blocking" mechanical interlocks prevent improper withdrawal of the breaker.



I-T-E Type KB Metal-Back Circuit Breaker

The circuit breakers for this new type of switchgear construction are the dependable, efficient I-T-E Types KA, KB, and KC. Standard ratings: 15-1600 amperes; 250 V. d-c, 600 V. a-c; from 15,000 RMS amperes to 50,000 RMS amperes interrupting capacity; 1 to 4 poles. The Multumite enclosures combine beauty with practicability: flush-type grille louvers, top trim-strip, formed end-panels, and baked finish give you an attractive as well as an effective board.

I-T-E

LOW VOLTAGE SWITCHGEAR

Modern Switchgear for Modern Applications!

I-T-E Circuit Breaker Co., 19th & Hamilton Streets, Philadelphia 30, Pa.

Power Switching Equipment Division: Railway & Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Phillips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS
MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

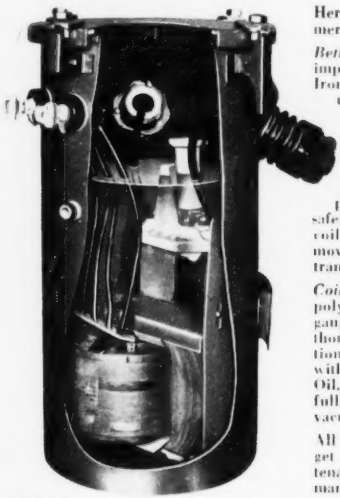
KUHLMAN FACT FILE
DISTRIBUTION TRANSFORMERS

DO YOU BUY TRANSFORMERS BY HABIT OR BY MERIT?

NO. 4-A OF A SERIES

COMPARE THESE KUHLMAN DISTRIBUTION TRANSFORMER MERITS BEFORE YOU BUY!

LESS WEIGHT	Kuhlman distribution transformers through 25 KVA are smaller, lighter, easier to handle because of the superior flux carrying qualities of the oriented steel found in Kuhlman's famous Bent Iron Core. This permits savings in steel, copper and oil which provide a weight reduction of 25% over transformers with hot rolled steel cores.
GREATER SHORT-TIME OVERLOAD CAPACITY	Kuhlman coils have extra large oil ducts which allow ample oil circulation. This eliminates "hot spots" and provides exceptional short time overload capacity.
LOWER EXCITING CURRENT	Lapped joint construction found in the Kuhlman Bent Iron Core provides as much as 75% reduction in exciting current compared with butt joint cores, and up to 32% reduction compared with continuous wound types.
COORDINATED INSULATION	Insulation is distributed throughout Kuhlman transformers to provide margin of protection at all points well above basic impulse level.



Here are other important Kuhlman merits:

Better voltage regulation due to the lower impedance of the smaller Kuhlman Bent Iron Core and the interleaved coil design used by Kuhlman. Reducing voltage drop is extremely important during peak load periods.

Lifting lugs are designed with rounded edges to protect lifting slings. "Quick-Grip" pocket bushings permit linemen to make connections safely and without use of tools. Core and coil unit can be quickly and easily removed, is bolted securely in place when transformer is in use.

Coils are completely protected with a polymerizing type varnish. The heavy gauge copper bearing steel tanks are thoroughly tested for leaks after fabrication, are then shot blasted and protected with three coats of high quality paint. Oil, refined to a degree which assures full stability, is put into tanks under vacuum.

All this points to one conclusion—you get better performance, economical maintenance, longer life when you buy Kuhlman distribution transformers!

Kuhlman ELECTRIC COMPANY
BAY CITY, MICHIGAN

EXPORT REPRESENTATIVES. *International Standard Electric Corporation,* 67 Broad St., New York City, N. Y. Cable Address: Microphone, N. Y.

TRANSFORMER TOPICS by KUHLMAN

QUESTION:

If a three-phase series-parallel winding is delta connected below and apart from the terminal board, what is the current in the leads from the delta connection to the terminal board?

ANSWER:

Let d-a be delta connections in fig. 1.

Let I_c be the current in each coil.

On the parallel connection.

$I_{da} = 2\ I_c$

$I_{AD} = I_c$

Considering the currents converging at X1, in fig. 2.

$$I_{L1} = 2I_c \angle 150^\circ + 2I_c \angle 210^\circ$$
$$= 2I_c\ (-.866 + j.5 - .866 - j.5)$$
$$= 3.46\ I_c \angle 180^\circ$$

$$I_{AA} = 2I_c \angle 150^\circ + I_c \angle 210^\circ = I_c$$
$$(-1.732 + j1.0 - .866 - j.5)$$
$$= I_c\ (-2.598 + j.5)$$
$$= 2.65\ I_c \angle 169^\circ$$

By symmetry, the same conditions exist at X_2 and X_3.

Therefore it is seen that the studs at A and the wire entering it must be proportioned for 2.65 x the coil current.

If all delta connections were made with links above the boards, studs need be designed only to carry I_c, provided ample nut and link contact surfaces are provided at junctions.

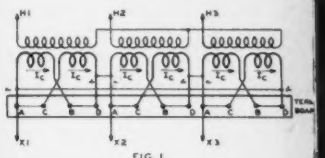


FIG. 1

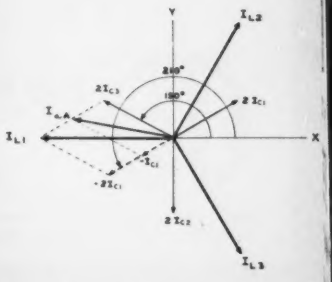


FIG. 2